



SOILS ALIVE

The Problem

Without healthy, fertile soil there can be no life. Simply planting in dirt will not produce plants and life forms necessary for the survival of life. The soils must contain organic matter and be able to transfer that matter into the food chain. This organic matter exists in three different forms or states: Living plant and animal matter, dead plant and animal matter, and decomposed plant and animal matter (Humus). While it is true that all humus is organic matter, not all-organic matter is humus. Four identifying characteristics of humus are: (1) Its origin or parent material can no longer be identified, (2) It must lose all its sugar, fiber, cellulose, lignin and protein, (3) It resists further decomposition, and (4) It is a minute amount of the parent material.

After organic matter decomposes to the point that it becomes humus, and then it can be further defined as either Humic or Non-Humic. Those elements we call Humic are the portions of humus that are soluble and have been named Humic Acid. Those elements non-soluble we call Humin. Both humic acid and humin play important roles in the fertility of soil.

What is this humic acid? To define humic acid we must look on a cellular basis. Each of us has learned of the life cycle in our education, but little was said of the "death cycle". This death cycle is the period of time where dead plant and animal materials are decomposed into plant nutrient for succeeding generations. The living cell contains a cell wall with a nucleus of liquid containing the DNA and genetic materials defining the function of the cell. When a cell dies and is deprived of oxygen, the liquids within the cell transform into two primary organic acids; Humic acid and Fulvic acid. Each of these two organic acids plays a role in the fertility and plant/animal life cycles. The humic acid is needed to break down the hard cellular wall and gluing materials of the cell; the composting function of soil. The fulvic acid is responsible for carrying the minerals from the dead cell and making it readily available to the next generations. Each of these two acids flow from the soil humus into the food chain. Nature always creates more than sufficient quantities of these organic substances. They will build up over time and thus increase soil humus percentages. Good soils may contain upwards of 6% soil humus while marginal soils will contain less than 1%.

Soil humus is detected by wet chemistry, so we have valid record of many of the US soils going back into the 1800's. In north Texas 1870 data indicated soil humus being recorded in the 4 to 6% range with most of the vegetation being virgin native range grass. These percentages represented a balance within the soil. Some humic substances were up taken by the plants while other humic substances were being deposited as plants died. There was a perfect balance in the natural flow of things. Early farmers determined that other plants could grow here which produced greater profits. These alien

TERRATOL, LLC

PO Box 161638 Fort Worth, Texas 76161

Phone (817) 614-3747 www.terratol.com Email info@terratol.com

plants to the ecosystem (Corn, Cotton, Wheat etc.) did not fit into the balance of things. They took more than they gave. To make matter worse, we harvested the fruits of the plant and further reduced the humic substance returned to the soil. By the 1930's soil humus tests in north Texas were ranging in the 3 to 4% range. During a 50 year period, we lost 2 to 3% soil humus. Farmers were noticing the change by reduced crop yields. At this time programs were institutes to assist the soil in rebuilding. Crop rotation, crop management, crop selection and other methods were accepted by the farmers to maximize yields and profits. Then in the 1950's with the advent of N-P-K fertilizers farmers were able to increase yields without as much soil management. The tragedy of this change on soil management has further reduced today our soil humus contents to the 1% range. In 1970, a farmer could raise good crop yields using 50 lb./acre of fertilizer. Today, 30 years later that same farm will raise only 60% of the 1970 yield and must apply fertilizer in the 250 lb./acre range to do so. All of this is a result of the lowering of the soil humus percentages.

Soil physical properties change when the soil humus is low. They compact, they tend to hold salts, they dry out non-uniformly and tie up trace minerals. The entire soil chemistry changes. All of these factors alter the fertility of the soil. New research is showing us that growing organically reverses some of the effects in the soil and starts the process of humus re-building.

Effects of Soil Humus on the Plant (Humic Acids Role)

Soil humus has three important components that play a crucial role in the life of the plant: Humic Acid (soluble composting function), Fulvic Acid (soluble mineral transfer function) and Humin (non-soluble soil amender). While the Humic is non-soluble and remains in the soil, Humic and Fulvic acids enter the plant as the plant uptakes nutrient.

Humic acid is probably the more important of the humic substances that enters the plant. It is carried into the plant with the nutrient that was formed by decomposition of dead plant matter. Upon entering the root structure the humic acid causes the permeability of the cell wall to open up allowing more nutrients to cross for cell metabolism. This process is thought to be caused by the humic acid's ability to stimulate plant enzymes and act as an organic catalyst in the plants nutritional processes. This factor allows for additional vitamin and mineral amounts to be absorbed by the cell.

While humic substances cause overall plant growth, studies indicate growth is primarily in the root structures. Humic acid causes cell elongation in root structure and increases the formation of root fine hairs. These fine hairs form along the length of the main roots and increase surface area exposed to the soil; more surface area, more nutrients. Studies comparing formation of fine hairs indicate that the addition of humates (humic acid) will increase the fine count several fold. Over all main root lengths are also increased. Recent data by Southern Illinois University showed corn plant root structures to be over two feet longer in soils treated with humates in the fertilizer program. Growth rates in the stem portions of the plants are directly affected by the humates, but not nearly to the extent as the roots.

Humic acid also causes the plant photosynthesis to be increased. This is quite evident in range grasses in the form of a deeper green coloration. Increased photosynthesis causes the formation of additional complex sugars within the plant. These complex sugars improve the taste of the plant or fruits. In test plots of coastal Bermuda, calves very quickly moved to the humate plots for grazing In

TERRATOL, LLC

PO Box 161638 Fort Worth, Texas 76161

Phone (817) 614-3747 www.terratol.com Email info@terratol.com

working with tomatoes, fruit taken from humate grown plants possessed three to four weeks longer shelf life due to the increased fermentation time of the more complexed sugars. In grape production for wines, these complex sugars produce much higher quality vintage. Besides improving the sweetness (taste), the humic acid plays an important role in the immune system of the plant. Complex sugars form glyco-proteins within the plant. These compounds attach themselves to the immune system cells and act as modulators (communicators) between the cells, allowing them to perform better in the defense of disease.

Seed germination is increased with the addition of humic acid. Recent studies on several vegetables indicated seed germination with humates averaged 7 days earlier than those not containing humates. Recently a Kansas farmer planted sunflowers that generally have a germination rate of approximately 88%. Crop spacing was established on this 88% factor. Humates were placed into the seed fertilizer and germination was estimated in the 95% ratio. Needless to say, hoeing was needed to thin the crop. Wheat germination times were decreased 5 days in west Texas studies. Not only was seed germination increased, but time of seedling growth in green houseplants was decreased. Pepper seedlings were ready for field planting 17 days ahead of controls.

Yields of fruits were increased with the input of humates. Recent studies over the summer on tomatoes indicated 5 kgs of tomatoes produced from the control and 9.5 kgs from the humates. Grape production from last years crop increased 1.5 tons per acre. In yield testing of granular fertilizer against fertilizer/humate blends on range grasses, it has been shown that 100 lbs/acre of chemical fertilizer added to 100 lbs/acre of humate produced the same yield as 200 lbs/acre of chemical fertilizer. Input cost to the farmer is the same for either program. Protein contents of the grass increase from 14% to 19% and the sugar content increase 24%. This is important when we consider the decrease in chemical fertilizer while soil building with humate and increasing the quality of the hay.

Fulvic acid doesn't stand out as predominately as humic acid in the role of plant growth, but it is important because it is the chelator and carrier of trace minerals to the plant. The form the mineral is in is extremely important. Fulvic acid's chelating role puts the mineral into what is called a "phyto-state" (plant derived) form that is easily absorbed by the plant. As example, if plants are in need of iron and nails are placed into the soil to remedy the problem, there will not be much effect. In fact, there will probably be some toxic effect from the elemental iron. The plant needs iron in a phyto form. Here the iron is completely digestible and any excess mineral is held by the soil for future uptake. Humates by their nature contain large amounts of trace minerals, which are chelated by fulvic acid.

The losses of soil fertility due to poor management of soil humus over the years can be reversed with the use of humates to replace the humic substances necessary for optimum plant growth. Application rates to the soil need to be in the 100 to 800 ppm (100 to 400 lbs/acre if using granular). Liquid humates are also available and can be applied folularly at the rates of one-quart to 1 gallon per acre.

Effects of Soil Humus on the Environment (Fulvic Acids Role)

TERRATOL, LLC

PO Box 161638 Fort Worth, Texas 76161

Phone (817) 614-3747 www.terratol.com Email info@terratol.com

Soil humus has three important components that play a crucial role in the life of the soil: Humic Acid (soluble composting function), Fulvic Acid (soluble mineral transfer function) and Humin (non-soluble soil amender). While the Humin is non-soluble and remains in the soil, Humic and Fulvic acids enter the plant as the plant uptakes nutrient.

Fulvic acid is a chelator, which means it binds with metals, being trace minerals, within the soils. It alters the form of the metal from its elemental state into a chemical state we call a "phyto" or plant derived state. In simple terms it binds the mineral with a carbon and allows it to be readily absorbed by the plant or animal. This is the form we receive our trace minerals.

Fulvic acid is an extremely strong chelator and binds with differing elements in unique ways. If a metal is important in the food chain (i.e. Copper, iron, zinc, etc.) fulvic chelates that metal and places an electrostatic charge on the metal ion so that it readily enters the food chain. Some metals such as lead, mercury, etc. are toxic to most living organisms. Fulvic acid also chelates these metals, but places a neutral charge on the metal ion that deters its entrance into the food chain. This is Mother Nature's way of protecting living cells from toxin within the soils. Research has indicated that as long as we have about 2% soil humus within the soil sufficient fulvic acid is present to filter toxins out of the food chain. Unfortunately, past and current farming practices have depleted much of our farmable soils of its humus contents.

As an example of what is occurring, consider that for 70 years our country burned leaded gasoline within our fuels. This pollutant, in trace amounts, spread across the surface of our country and in effect raised the background level in our soils. Without sufficient soil humus containing the fulvic acid, lead is entering the food chain. Granted it is in extremely small amounts, but it and other similar toxic minerals can be cumulative and over a period of years can and will effect the health of plants and animals.

I have addressed what happens during the mobility of the chelated trace mineral, but what happens to them as they reside within the soil. Fulvic acid, in conjunction with humic acid, binds the minerals to the clays within the soil. This tends to prevent leaching into the ground waters and streams. Dr. Peter Warwick with Lethborough University in England has been researching the chelating ability of fulvic acid to bind and hold radioactive isotopes in the soil. Dr. Warwick is the radiation safety officer for the European Super Collider in Belgium and is many times asked for remediation solutions to real and postulated radiation contamination resulting from the Super Collider activities. He and his staff have studied the soil and use fulvic acid as a chelating agent within the soil to immobilize the contaminant. Just immobilizing the contaminant is not the total remediation answer. How long is the chelation stable and how immobile is the contaminant? No one knows for sure, but computer models developed by Dr. Warwick's group predict the chelation is stable for many thousands of years provided there are no drastic changes in pH. The fulvic acid places the contaminate into a state that is non soluble and bound to the clay particles of the soil. Due to its neutral charge, it cannot chemically react and therefore is effectively immobilized. Although we are not dealing with radioactive isotopes in our farming soils, we do have toxins within those soils in which the same chemical interaction is occurring. Fulvic acid is Mother Nature's environmental protection agency and when our soil humic is low, we are not receiving the protection.

TERRATOL, LLC

PO Box 161638 Fort Worth, Texas 76161

Phone (817) 614-3747 www.terratol.com Email info@terratol.com

Another issue related the fulvic acid along with its counter part humic acid is regarding non-metal and organic loadings within the soil. There has much in the news of nitrate and phosphate run-off depleting oxygen within our stream waters. Additional organic overloading from large animal confinement areas has created similar water quality problems. Both are a function of the soil humus not containing sufficient amounts of humic and fulvic acids to handle the problem. Recently I was in a meeting with a local county commissioner discussing this problem. A planned housing development is being platted in a rural area on a 120-acre pasture. This farm had been used for hay production and was fertilized several times annually. For hypothetical purposes let's assume the farm was fertilized with 200 lbs per acre for a total of 24,000 lbs of chemical fertilizer on each application. This fertilizer loading created some run-off. Now consider the development plans call for ¼ acre home lots creating 480 new yards and flowerbeds surrounding each home. Typical homeowners will fertilize more often and with greater loading to create the "green look". Assuming each homeowner puts 50 pounds on the front yard and 50 lbs on the back yard, the total fertilizer loading for the 120-acre tract is now 48,000 lbs.; double the problem. Additionally, each home will have a septic system. This development will create 480 septic tanks placing additional organic loading into the ground, which eventually migrates into our streams and lakes.

Our soils in these rural areas are depleted in humus and do not contain sufficient humic and fulvic acid to handle the increased pollutants associated with urban sprawl. No programs are in effect to assist or educate the homeowner or farmer in rebuilding his soils. Currently Texas law does not permit county commissioner's court to address zoning in the rural areas, therefore this problem is only going to become more intense.

There is no "silver bullet" that is as easy solution to the problem, but growing organically and using natural materials to rebuild the soils is a big start in addressing our soil and environmental problems.

Effects of Soil Humus on Animals

Humate, the generic name for soil humic substances, is a natural safe material that exists in varying levels in all soils. It is natural to the food chain and plays a role in animal health and nutrition. The nutritional value of feed is dependent upon the health and quality of the soil. Soils transfer minerals and humic substances to the plants and are rated for quality by such things as protein and vitamin/mineral content. Little notice has been given to the amounts of humic substances from the soil that also flows into the food chain.

Safety and toxicity studies on humates have shown the materials to be safe at levels far exceeding normal natural amounts. The Drepropetrovish Agricultural Institute in Moscow studied large dosage inputs into animals and found no ill effects on the blood, cardio-vascular, endocrine and reproductive systems. A company in California further demonstrated non-toxic effect on cellular structures in animal and human. Humates being fed to dairy cattle have shown no change in milk chemistry.

Blood properties of animals being fed humate have been examined and no ill effects were observed on bleeding time, clotting time, plate counts or induced platelet aggregation. Recent studies by Texas Tech University indicated increases in iron in the blood hemoglobin as a result of the humates. The increased iron infers additional blood oxygen. Russian studies on chickens indicated increases of blood oxygen of up to 10%. Field studies on performance horses (racing and cutting) have shown

TERRATOL, LLC

PO Box 161638 Fort Worth, Texas 76161

Phone (817) 614-3747 www.terratol.com Email info@terratol.com

that racing or reaction times can be reduced by this method of blood oxygen increase.

Nutrient uptake by the cells is affected by the humates. Humic acid research has shown increases in cell wall permeability (opening of the cell wall) allowing nutrient to be up taken by the cell. This effect produces an increase in feed conversion (more weight per unit of feed intake). . Studies at Texas A&M University on cattle indicated a 13% increase in feed conversion. Russian research on chickens showed a 5% increase.

Mineral and vitamin uptake are likewise increased by humates. The Journal of Orthopedic Trauma Surgery reported a 16% increase in bone calcium transfer in cattle. Field reports from emu producers tell of reductions in hoof rotation. Emu have long legs and muscle development in young bird can sometimes out grow bone resulting in deformation of leg bones. Humates seem to balance growth of bone and muscle equally.

Researchers at Penn State University report suppression and reduction of stress causing hormones in animals fed humic acid. Their testing on rats physically restrained to cause stress showed significantly lower stress causing hormones in those animals being fed humic acid. This has been observed in animal behavior with show calves first entering the arena. Animals on humate are less affected by outside stimulus of crowds or confining areas. Hogs confined in breeding and fattening houses appear more serene with less fighting and aggressiveness. Dairy cattle are less affected to extreme temperatures especially in summer months and will produce more milk as a result.

Cell division is affected by humates. Humates enter act with DNA in cellular division to prevent cellular mutation during cell reproduction. Just recently cancer researchers from Clemson University who indicated that humic content within cells decreased radiation induced cell mutation contacted me. Other technical papers were noted during literature research for this article regarding cancer research with humates.

Humates are known to stimulate microbial activity. Microbes and their associated enzymes are essential for many body functions including digestion. Increased microbial activity in the “gut” digests feeds more efficiently causing the waste manure to contain less nutrient and odor causing elements. Odor reduction tests by Texas A&M indicated a 67% reduction in ammonia and hydrogen sulfide (rotten eggs smell) in manures of cattle being fed humates. Field-testing with hogs and chickens has provided similar reductions in manure odors.

In contrast the humates have also shown anti-microbial properties on certain types of microbes. It seems that within the body, humates stimulate the “good” microbes while suppressing the “bad”. Testing of milk during field trials indicated a large increase of microbes within the milk. This is usually an indication to the dairyman of impending mastitis (tit infection). The opposite actually happened. Mastitis cases within the milking herd dropped from an average of 3 to 4 cases daily to 4 cases per month. Additional conformation of mastitis reduction was observed in lactating female goats. Three female goats with severe mastitis were administered doses of humates over a two-week period. At the end of 7 days, swelling of the mammary glands had subsided and the goats were back to normal activity allowing the kids to nurse without discomfort. This was done without antibiotics.

TERRATOL, LLC

PO Box 161638 Fort Worth, Texas 76161

Phone (817) 614-3747 www.terratol.com Email info@terratol.com

Humates booster the immune system. They cause the body to manufacture glyco-proteins that act as regulators or modulators of the immune system cells. This immune system modulation causes the body not to attack itself quite as aggressively. In the case of older animals with arthritis it is observed that inflammation of the joints is reduced and less pains is seen in the animal. Death losses in hog, chicken and cattle confinements have been greatly reduced with the addition of humates to the feed regiment. Recent studies on weaning calves in feed lot operations showed a major reduction in “shipping” fever and those cases reported with less severity. Recent clinical work on West Nile Virus in horses showed better recovery times and vets have indicated a possible prophylactic effect to prevent the horse from catching the disease.

The trace minerals contained within the humates provide for a healthier, better-looking animal. Hoof growth on horses has been increased and reports from vets have shown rapid improvements in split and worn hoofs allowing shoeing on previously hopeless cases. Hair lanoline is increased. Coats on horses and cattle have shown marked improvements. Farmers have reported slick coats on horses even during the coldest portions of the winter. Angora goats have shown major improvements in the quality of fleece.

Soil humus provides these humic substances through the food chain. When soil humus is low from poor farming practices then the quality of feed is diminished and health issues within the animals are affected. These deficiencies in humic content can be remedied by changing our fertilization programs toward organics that start the rebuilding process of soil humus.

For those wishing to obtain more information on humate health issues in animals, the American Medical Association administers an Internet database called “Medline”. This database can be accessed through any search engine. Once into Medline, search with the terms “Humate”, Humic Acid” or “Fulvic Acid”. Medline is a ready reference of current world wide medical research on a large variety of topics and the technical papers are a “for-fee” service to doctors and vets. The abstracts on each paper are free.

Effects of Soil Humus on Humans

We humans consider ourselves to be at the top of the food chain. Realistically, this isn’t the truth since we, like any life form, die and our makeup returns to the soil to provide nutrient for future life.

We are just a part of a chain of hydrocarbons and nutrient cycling again and again. Malcolm Beck penned an interesting article recently in this journal stating he desired to be composted upon his death and returned into the never-ending cycle. What is true is that our bodies are what we eat. Our health, well-being and life are affected by the foods we eat. Deficiencies as well as surpluses in our diets affect our bodies. All foods are derived from the soil and the health of the soil dictates the quality of the food we ingest.

This article has focused on the lack of sufficient humus within our soils and its meaning to the up line food chain. If soils are low on minerals, then the plants grown on the soil will be low on minerals and so on up the chain. Soil humus in the forms of humic and fulvic acids play extremely important roles in transferring nutrients and minerals to our bodies. Farmers and associated researchers have long overlooked the humic substances importance. Nationwide the levels of humic substances have dropped below amounts necessary to provide the human body with certain

TERRATOL, LLC

PO Box 161638 Fort Worth, Texas 76161

Phone (817) 614-3747 www.terratol.com Email info@terratol.com

protective elements.

Research at Texas Tech University has shown humic acid to increase iron in blood hemoglobin. This increase causes the blood to carry additional oxygen making us have more energy and feel better. Additionally, more oxygen causes us to heal faster and relieve pain from arthritic conditions.

Increasing humic acid, as a supplement into the diet, has shown reductions in anemia especially in maturing teenage females. Not only do these humic substances cause more oxygen, they regulate blood clotting. Humates are used in the treatment of hemophiliac conditions of Von Willebrand Disease.

Humates are known to suppress stress-causing hormones within the body allowing us to relax and rest. Anecdotal evidence coming from businessmen with high stress jobs report better quality sleeping and rest allowing them to think and perform better on the job.

Humic acid improves liver function. Blood testing has shown decreases in cholesterol over time and increases in percentage of amino acids in the blood. This infers that the body is processing the fats for energy and building more muscle tissue from the increased amino acid percentage.

Humic acids complex sugars within the body and ultimately build the immune system. Complex sugars cause the creation of glyco-proteins, which in turn act as modulators or regulators for the killer and T cells of the immune system. Either killer or T cell imbalances contribute to many autoimmune diseases. If the killer cells are predominant then arthritic conditions may exist and likewise if the T cells predominate diabetes or other type immune diseases may exist. The humic acid tends to regulate and balance the immune system. Although little research is available, it makes sense that allergies are probably associated with the immune system imbalance. Research at Baylor Medical School has shown that humic acid causes the immune system to recognize its own body's dead cells and reduces the aggressiveness of attack. Baylor commonly treats burn victims with humic solutions to retard infections caused by an over aggressive immune system. Russian literature also indicates radiation sickness (immune system response to dead cells) is greatly reduced and survivability is increased accordingly.

Humic substances are showing great promise as antiviral materials. It is thought that components of the humic acid attach to the receptor sites on the virus preventing them from mating and sharing DNA and RNA from host cells in their reproduction process. If the virus cannot reproduce, it will quickly die out. Recent work by the National Institutes of Health tested natural humates with drugs of choice on several common diseases (Herpes, Colds and Flues). In all cases the natural humate showed effectiveness. In several diseases the natural humate worked better than the drug of choice. Humate effectiveness on Mononucleosis (Herpes Virus) was 5 times better than the drug of choice. In a large number of flu viruses the humate was equal with the drug. FDA research is currently on going with the humates as possible drugs on HIV/Aids, Hepatitis C and several of the "baddies" such as Hanta and Ebola. Humate appears to have universal effects that prevent viruses from mutating and going around such as occurs with synthetic drugs.

Humates carry large amounts of trace minerals into the body. These trace minerals or lack of minerals are responsible for many of the ailments affecting mankind. The body needs over 70 different trace minerals in the correct ratios to function properly. Dr Dan Murry has been studying

TERRATOL, LLC

PO Box 161638 Fort Worth, Texas 76161

Phone (817) 614-3747 www.terratol.com Email info@terratol.com

sea salt as an additive to fertilizers to cause plants to carry more trace minerals. A comment in his book on the sea salt subject caught my attention. The balance of minerals in saturated seawater is exactly the same composition as human blood. Humans cannot directly inject seawater minerals because they must be tied to carbon before they can enter the body; therefore he is using the sea salts as fertilizer to introduce the minerals into the food chain. The plants absorb the sea salts and attach them to the carbon whereby the human can benefit. Humates by their origin already contain the trace minerals attached to carbons.

Recently, I was contacted by a group of researchers from Calgary, Alberta, studying the effects of trace mineral on central nervous system disorders. They related that natural chelated trace minerals such as those contained in humic acid has significant effects on learning disorders such as ADHD. Their studies indicated that elementary aged children could be taken off drugs and made to function normally by supplementing their diets with natural trace minerals. They feel that balanced trace minerals are required to interact with enzymes for nearly all of the body's metabolic pathways. Trace mineral deficiencies are definitely a major cause of most central nervous system dysfunctions.

Healthy soil containing humus in quantities of 2% or greater will contain humic substances in sufficient amounts of provide health and protection to our bodies. Chemical usage in our agricultural programs has caused the depletion of the vital humic acids from our diets. Growing organically, using humates to assist in the restoration of soil humus will be a large step in correcting the problem. The humic substance and health issues discussed above can be implemented into the food chain in a number of methods: Applying humates into the fertilizer program, inoculating the produce or feed coming from the land, supplementing humates into the feed regiment of the animal, and taking a daily supplement of vitamins/minerals containing humic acid.

The FDA has not evaluated statements made in this paper. Humic Acid products are not intended to diagnose, treat, cure or prevent any disease. Please contact your physician for additional information.

How to Improve Soil Humus

This article has focused on the lack of sufficient humus within our soils and its meaning to the soil, environment and up line food chain. If soils are low on soil humus, then the plant quality grown on the soil will be poor unless chemical and/or organic inputs are added. Soil humus in the forms of humic and fulvic acids play extremely important roles in microbial activity, composting, transferring of nutrients and minerals and overall nutritional values. Farmers and associated researchers have long overlooked the humic substances importance. Nationwide the levels of humic substances have dropped below amounts necessary to provide proper soil health.

The first thing an individual need to do is to obtain soil samples from his property and submit them to a soil laboratory for analysis. These analyses are important whither you are a home owner with a yard or garden or a large commercial farming operation. This analysis established a base line indicating deficiencies and/or excesses that must be addressed to build a healthy productive soil. One should select four or five representative locations from his property to take samples. A sampling size of one cup taken from a depth of 3 to 6 inches is sufficient. The four to five individual samples can be commingled or mixed together into one overall amount representing the whole

TERRATOL, LLC

PO Box 161638 Fort Worth, Texas 76161

Phone (817) 614-3747 www.terratol.com Email info@terratol.com

property. The laboratory will need a minimum of about one quart of soil to perform its work properly. Locations and/or recommendations on soils labs may be obtained by contacting your local County Agent or USDA Soil Conservation Office. The standard soil test generally contains all of the information necessary to beginning a soil-rebuilding program.

Once the soil analysis report is obtained then information of needed inputs can be known. Most lab reports are fairly self-explanatory, but help is at hand from your local County Agent if need be. Also many of the lawn and garden/farm and ranch stores have experience personnel to advise. Of the information one receives back several items are of importance:

Soil pH.

Soil pH is a measurement of the acidity or alkalinity of your soil. The pH scale ranges from 1 to 14 with seven being a neutral soil. Numbers below 7 are considered acid while numbers above seven are considered alkali. Virgin native soils in Texas and Oklahoma generally range from 7.2 to 7.8, slightly alkali. This pH is ideal for growing grasses in lawns. Some plants though need slightly differing pH. As example azalea bushes and blue berries require acid soils ranging from 6.2 to 6.5 pH for best growth. Soil pH can easily be adjusted with either sulphur to lower pH or lime to raise pH added to the soil. For most native plants a soil pH of 7.2 to 7.8 is optimum.

Organic Matter or Soil Humus.

Organic matter/soil humus is measured in percentage. Virgin local soils contained 4 to 5% soil humus. Today most soils have been depleted in soil humus and readings of 0.75 to 1.5% are common. Research has indicated soil humus content of 2% or higher is required for healthy soil. The addition of compost, manure or humate will begin the process of rebuilding soil humus. If one is using humate the applications of 5 lbs/1000 sq ft (200 lbs/acre) will be sufficient to gain between 0.3 to 0.5% soil humus.

Salts or Sodium.

High levels of salt or associated sodium are detrimental to plant growth. The salts originate in the soil from higher than desired salts in irrigation water, high levels of chemical fertilizer application, or highly alkali soils being exposed to acid rain. Salt will build up little by little over time and in clay soils will pool at root level. Remediation can be acquired by either deep tillage to allow salts to percolate below root level or application of humate to break down the salt. If using humates, an application of 5 to 10 lbs/sq ft (200 to 400 lbs/acre) is sufficient to make large reductions in salts.

Cation Exchange Capacity-CEC (meq/100 gm)

The Cation Exchange rate is a measurement of the ability of the soil to transfer minerals from the soil to the plant. A low CEC soil does not have the ability to transfer minerals while a high CEC causes minerals transfer in excessive amounts. A proper CEC range should be in the 8 to 15 range. CEC amounts over 20 need serious considerations and soil amendments to correct the problem. High salts will cause high CEC. The additional of humates at a rate of 5 lbs/1000 sq ft will aid in the correction of either high or low CEC.

TERRATOL, LLC

PO Box 161638 Fort Worth, Texas 76161

Phone (817) 614-3747 www.terratol.com Email info@terratol.com

Nitrogen-Phosphorus-Potassium N-P-K

N-P-K are the primary components necessary for plant growth. These are the normal components to chemical fertilizers, but they are also present in organic fertilizers. When one purchases fertilizer there exists a number on the label such as 21-7-14. This particular fertilizer contains 21% nitrogen, 7 % phosphorus and 14% potassium. By multiplying the respective percentage by the number of pounds of fertilizer applied one can calculate the amount of each actually applied to the soil. As example if one applied 50 lbs of 21% N fertilizer he would be actually applying 10.5 lbs of N to the soil. The lab analysis will generally give recommendations on the amounts of each item needed to balance plant growth. Most generally the lab analysis is providing recommendations based on one-acre application rates. One acre equals 43,560 sq feet. Most homeowners need the data in lbs per 1000 sq ft. To convert divide lab recommendation by 43.56 to obtain in lbs/1000 sq ft.

Major Minerals

Major minerals such as calcium Ca, sulphur S, magnesium MG, Iron Fe, will be given on the lab analysis. The analysis generally provides excesses or deficiencies of the major minerals. On to watch in particular is the calcium. On low soil humus soils with low pH (acid) the lab analysis often indicates high calcium and/or magnesium (major components of limestone; a highly alkali material). How can high calcium and/or magnesium be high and the soil acidic? This occurs because the calcium and magnesium are locked up within the clays and are not accessible by the plant or to the soil as a neutralizing agent. Raising the pH with lime will correct the problem.

Now that we have reviewed some of the data on the lab analysis we can provide a base fertilizer program using mainly organic or natural products to build soil humus while maintaining plant growth.

In the early spring the following should be applied

100 lb/acre (5 lb/1000 sq ft) granular humate

100 lb/acre fertilizer as recommended by soil analysis

After Green up or at seedling phase of plant apply

1 to 2 quarts/acre of a bio inoculant containing humic acid

5 gallons/acre of high protein liquid cattle feed (molasses)

At mid season apply

1 to 2 quarts/acre of a bio inoculant containing humic acid

5 gallons/acre of high protein liquid cattle feed (molasses)

In fall apply

100 lb/acre (5 lb/1000 sq ft) granular humate

TERRATOL, LLC

PO Box 161638 Fort Worth, Texas 76161

Phone (817) 614-3747 www.terratol.com Email info@terratol.com

100 lb/acre fertilizer as recommended by soil analysis

This program along with any additions from recommendations of the soil test will result in good plant growth and a rebuilding process on the soil humus. Once the soil humus has reached a 2% level or above the need for fertilizers and other amenders will be greatly reduced. This is the key to long term agriculture.

Each year a new soil test should be performed so that one can observe progress. Remember the soil did not get into a poor condition “over night” and one cannot expect to correct conditions “over night” either.

TERRATOL, LLC

PO Box 161638 Fort Worth, Texas 76161

Phone (817) 614-3747 www.terratol.com Email info@terratol.com