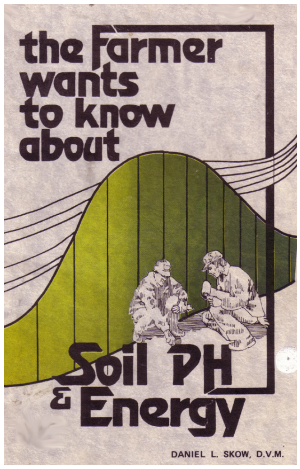

SOIL & pH ENERGY

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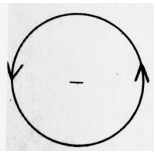
This booklet is being written to help farmers better understand something about plant food energy and pH readings. There has been, and still is, a lot of misunderstanding about what a pH reading really is and what it has to do with the growing of crops. In order to explain the real scientific meaning of pH readings, let us begin with a single atom of hydrogen containing only one negative and one positive charge of electricity. Atoms are made up of electricity. The difference in various elements is the difference in number of negative and positive neutrons and protons that make up an atom of an element. The hydrogen atom was chosen as a working Jpase element because it contains only one negative and one positive charge and is an easy, natural base for a mathematical equation from which a pH value may be determined.

In soil chemistry, the symbol used for anions is a minus (-) sign. This has been interpreted as meaning alkali or sweet. The symbol used for cations is a plus (§) sign and has in the past meant that the soil is acid or sour.

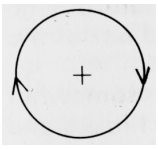
In this booklet I refer to the ion or ions as always being the core of any atom and the electron or electrons as being in outer orbit around the nucleus regardless of whether they are anions or cations. Unless this principle is kept well in mind, one will not be able to distinguish the acids from the bases. Bases are alkalis only.

The principle of the pH theory is based on the structure of the hydrogen atom. The positive hydrogen atom is composed of one negative ion and a nucleus, or center, with only one positive ion. The cation electron is rotating counter-clockwise.



The ion here is an anion. The cation electron is in a counter-clockwise outer orbit. Therefore, this hydrogen atom is an acid (-).

The earth, with the moon rotating around it, illustrates the principle of a hydrogen atom. Substances, with the cation electrons in orbit, are acid elements or compounds. The anion hydrogen atom is made up with a cation as nucleus and an anion for an electron in orbit. Such atoms or molecules are known as bases, meaning alkali or sweet. 1



The cation here is the nucleus and the anion electron is in outer orbit. Anions always orbit clockwise. Therefore, this hydrogen atom is base (+).

These two drawings show the real scientific differences in acids and bases. Acids are considered to be sour and bases to be sweet. The three main sources of base or sweet fertilizers are potash, calcium and chlorine. All other elements used for fertilizers are, more or less to a degree, acid.

Some elements are isotope elements. Isotope elements or compounds are those in which the anions and the cations change places in the atomic structure of the substance. The anion or cation in the isotope elements or compounds yields to the side with the greatest magnetic pull. One may have soil in excellent condition one day, and the next day it may be about as far out of balance as it can get. This is due to the instability of the isotope substances. Only trained scientists can measure and predict these changes before they happen. Two weeks or more may be lost if one has to wait for visible signs in order to make or guess at the corrections needed. This often means the difference between a profit or loss. An example would be tomato plants which do not set blossoms. This problem can be determined by a soil analysis before it happens and can be corrected by adding certain fertilizers before it is too late in the season.

In order to give one an idea of the size of an atom, let us imagine the center ion of an atom is enlarged to the size of a golf ball. The distance from the center of the ball to the outer-most electron in orbit would be about 1,730 miles at 60 degrees C. It is presumed that all elementary atoms are the same size when brought under like temperature and pressure in ratio to their atomic number and specific gravity. The greater the number of protons and neutrons within the atom, the greater the 2 specific gravity and weight. Therefore, iron is heavier than aluminum; manganese is heavier than

magnesium; iron will float on boiling lead. The heavier elements in the soil naturally go down, and they very often go too far down and out of the range of plant roots.

Dealing with such small trifles as atoms is somewhat difficult for farmers when they are handling fertilizers and produce by the ton and are constantly manipulating large tractors and trucks. Nevertheless, the managing of the atoms is just as necessary and important to plant feeding, and has just as much to do with success, as does the machinery used to plant and harvest crops. Plants are made or built atom upon atom and molecule upon molecule.

Molecules and atoms are held together by a jigsaw puzzle arrangement which scientists call magnetism. The source of the magnetism is an electrical current moving over the crust of the earth toward the north magnetic field, drawing like things together. The same current causes a compass to point north. This same force moves in the line of least resistance. As it moves towards the north, it carries metal particles and stores them in veins. As metals attract each other, they form ore deposits. This same kind of magnetism builds plants and trees in like manner as veins of ore are established in the earth. A pH reading is a measure to this current's speed on its way to the north magnetic field. The pH scale for soils begins at 00 (zero-zero) and goes up to 14. Sulphuric acid has a pH value of zero-zero (00) on this scale. This is because an electrical current passes through it at the speed of light (186,000 miles per second).

Electrons rotate at a greater speed when the electrons are cations. When heat from an outside source (such as solar heat) is brought to bear on the matter, it slows down the action somewhat. This results in a pH value change.

Anion electrons do just the opposite. They can be made to rotate at greater speeds by induced or solar heat and results in a lower pH reading. These factors cause the pH reading to rise or fall because atoms in the molecular construction of the isotope substances are constantly changing 3 place. The friction brought about by this chemical change is combustion when fire or flame is present. It is simple decay when it is not. Decay is generally brought about either by bacterial or fungi action or both. The greater the speed of the electrons in orbit around the core of the atom or in the molecule, the lower the pH. The exception is a case wherein heat is applied and no ammonia is present. This is due to the fact that ammonia freezes, which slows down the electrons and causes the pH to rise. The slower the electrons rotate, the higher the pH reading. The direction of the rotating electron has much to do with the speed. When the electron is a cation, it has a tendency to increase in speed; when it is an anion, it has a tendency to decrease in speed. Each of these is true when only the natural soil chemical action is taking place. Solar heat has a very great bearing on these actions. Under certain soil conditions, sun heat can cause the pH reading to rise. Under other soil conditons the same degrees of sun heat can cause the pH reading to drop. This is due to the presence of ammonia in the soil. The slower the electrons rotate, the higher the pH reading. However, this theorem is only partly true, because of the direction in which the electrons are traveling.

Calcium in its purest state has a pH of 14, and it is considered a nonconductor of electrical currents. The neutrons, which rotate around the proton in calcium, move as slowly as it is possible for them to move and still make the element, calcium or lime.

The number seven (7) is considered to be neutral because water has a pH of 7.00. Water is a solvent, and it is the best soil plant food catalyst known. Soil elements or compounds whose electrons rotate faster than those in water are now classified as an acid in soil nutrients. Those elements or compounds whose electrons rotate slower than those in pure water are said to be alkali. In the purest scientific sense, this is a contradiction, but I am now stating what is considered acid or alkali regardless of the true scientific classification. Consequently, a false impression results relative to what constitutes sweet and sour or acid and alkali soils. 4

The speed with which the electrons actually rotate in the soil compound substances has very little to do with direct plant feeding and the pH reading. The conductivity of the plant food proteins does have much to do with the rate of growth of plants. The pH reading does greatly effect the forming of plant food proteins which are direct plant food. In the molecular structure the proteins become more or less good or poor conductors of the electrical current passing over the crust of the earth. THE pH READING IS AN ELECTRICAL MEASUREMENT OF THE RESISTANCE BETWEEN THE ACIDS AND ALKALIS PLUS THE MAGNETISM OF THE ELECTRICAL CURRENT FLOWING OVER THE CRUST OF THE EARTH.

The rate of this flow is largely determined by the molecular structure of the soil. The difference in elements and compounds is only the difference in the number of anions or cations in orbit in the molecular structure. ELEMENTS ARE TRULY ALKALIS WHEN THE PROTON IS THE NUCLEUS AND THE NEUTRON IS THE OUTER ELECTRON. WHEN THE NEUTRON IS IN THE CENTER AND THE PROTON IS IN THE ELECTRON* THEN THE MOLECULAR STRUCTURE IS AN ACID OR METAL WHICH WILL CONDUCT ELECTRICAL CURRENTS.

When cations are the center of the atoms and the anions are the electrons, then the substance becomes a poor conductor of electrical currents. Opposite factors have greater attraction for each other when the space is greater between the orbiting electrons. For this reason, plants grow better in warm weather than they do in cold weather. Naturally there are extremes in heat and cold. When the temperature rises about 90 degrees F. the speed of the electrons becomes so great that plant roots cannot magnetically attract the plant food elements and hold them because of their momentum. The greater the speed, the greater the heat becomes and the greater the soil's holding power of heat. This is true of both high and low pH readings as long as this exists.

Acids and alkalis have an attraction for each other because the anion at the center of the cation atom attracts the cation which orbits the cation atom. Like things attract each other even though no 5 energy is given off by the anion. The same is true regarding the cation attraction of all elements and compounds which forms the foundation for the structure of magnetism. Without this, there would not be any life on this planet. At such times, when these opposite forces come into contact with each other, they begin to grind each other down just as you see sparks when metal is introduced to a rotating emery stone. The sparks are small pieces of metal and stone which the friction has ignited as the particles or molecules were separated from their main structure. The flash of fire is the final separation of the metal back into its atomic elementary and molecular components. The light you see is atomic heat just as it is created in the atomic bomb. The amount is so small that it is harmless.

Energy is heat. Heat is light. Light is electricity. Therefore, plants must have light to live and grow.

Heat created by acids coming into contact with bases is nature tearing us under by chemical action the applied fertilizers. Whatever organic or inorganic substances there happens to be in the soil also takes part in this chemical action. Too much heat, at such a time, burns the roots, releases too much nitrogen, promotes oxidation of calcium and phosphate and will leave a very low plant food bank account.

Fungi and bacteria have their part in bringing opposite forces into contact with each other to form plant food energy. Active colonies of aerobic bacteria in soils is nature's way of preventing over oxidation and waste of applied or nafural substances. It behooves every grower to keep his soil free of ingredients which are harmful to the soil aerobes. Aerobic bacteria is the nitrifying bacterium. These small animals store nitrogen into soil compound molecules. Such molecules are protein molecules.

The aerobes are small, one cell animals that take in plant food by absorption and procreate by division. They do not ordinarily die, but go into a dormant stage when soil conditions become unfavorable. They are put together by a process known as ionization, the same method that causes plants to grow. A like chemical action is brought about when metal plating takes place in plating 6 tanks. The aerobic bacteria is taken apart by the same method in which it is formed, except the method is in reverse. (If the reader will note the diagrams showing the direction of the orbiting of the electrons on pages one and two of this booklet, he will get a better mental picture of how these opposite forces coming into contact with one another cause friction - give off heat - which is plant food in protein form). The aerobes in the soil convert everything possible into protein molecules in spore form. This aerobic bacterial spore is nature's way of preventing plant food from leaching. This makes the soil quite gummy and also helps prevent erosion.

The electrons that escape, in the form of heat or otherwise, do not necessarily return to their former atomic or compound state. Some are used by plants and some help form other elements or compounds which may or may not aid plant life. Others are drawn into and become part of the soil aerobes. Regardless of whatever happens, the change has been brought about by the heat of the escaping electron in the form of static electricity. Therefore, we can say that plants live on energy and that their growth and production is determined by the supply of this energy.

The difference in the speed of the rotation of the electrons in orbit will make a difference in the diffusion of energy. The greater the speed, the greater the amount of energy which is released. The intensity of the anions and cations reaction is the direct reason some fertilizers give better results than others. Changing weather conditions cause changing soil conditions. As two seasons are never alike, consequently there are never two seasons when the same fertilizer will give the same results. A fertilizer which gives an abundant harvest this year may cause a crop failure the next year.

The speed of the electrons will be changed upon coming into contact with other electrons regardless of their likeness. This process forms new compounds. They may differ from the element or compounds, which may differ from the element or compounds from which they came. 7

Therefore, this new compound substance will have an electronic speed or pH reading all its own. THIS PROCESS IS KNOWN AS THE IONIZATION PROCESS. The static electric current which makes up the elements and compounds is the frequency of the substance. All substances having like frequencies are of the same KIND even though the molecular structure may differ. Were this not true, there would be only one KIND and only one SPECIES living upon the earth.

Elements or compounds having different wave lengths come into the presence of one another and a short circuit or interference results because of the friction. The friction gives off light or electrical energy which results in minute amounts of heat per molecule. A few million molecules in a gram (about 1 /27 of an ounce), all in confusion, can give off considerable amounts of heat. Excessive heat causes the roots to sweat or to be dehydrated. Moisture flows out instead of in. The process of osmosis can no longer function. Such conditions are called burning of the roots. The plant is severely shocked and may die unless the condition is corrected or runs its course.

Water expands when heated or frozen. Damage to plants is the same whether it is caused by weather, fire or fertilization practices even though it may appear to effect the plant differently. In each case the cell structure is either broken down by direct exposure, or it is broken down as a result of the exposure. The flow of moisture carrying the vital plant food elements and compound molecules has been interrupted. The degree of benefit or damage depends on the quantitative amounts of plant food energy which is given off by this process in a given length of time. Heat, when given off in a minute amount, is the basic foundation of plant feeding. The amount required depends on the kinds of plants, their ages and the season in which it is present. Please do not forget the effects of water or soil moisture on heat. It may be an asset when it is present in right amounts and a curse when there is too much.

THE RATE OF ADJUSTMENT BETWEEN MOLECULES IS THE RESISTANCE BETWEEN 8 MOLECULES* WHICH WHEN MEASURED IS A pH READING. Therefore, let us conclude in a broad sense that the pH reading is the measure of the electrical resistance between the acids and the alkalis in the soil. It is also the resistance of the adjustment of elements whose electron speeds were different when the chemical process began from that when the process was in action and when finished. The elementary structure of the new molecules makes the soil either a good or poor conductor of the earth's gravitical electrical currents. These currents carry the plant food energy over the surface of the roots and the roots, accepting this energy by magnetic attraction, is the beginning of the process of osmosis. A NEW CHANGE IN ATOMIC STRUCTURE MEANS A NEW pH READING. Good pH readings are those which are constantly changing within certain limitations. Varying soil conditions can, and do, change the limitations many times a day.

A pH READING DOES NOT SHOW WHEN LIME OR POTASH IS NEEDED, even though it may denote such to be advisable and is wrongly used as such. Adding too much lime or potash at one time can do great harm by releasing too much energy in too short a time. This can cause starvation in the following crop because the soil acids have been so neutralized that there is no longer any resistance.

The three most commonly used ingredients for sweetening soil are ashes, lime and chlorine from muriate of potash. A pH reading is WRONGLY used when used for the sole purpose either of denoting whether an alkali is needed or what form of alkali is needed. Either or both of these factors can cause a farmer to operate far below his capacity and are many times the absolute reason for great financial losses.

Lime comes in many different forms and strengths. Some forms of lime contain as little as 30% calcium while others contain up to 99% calcium. Some forms of lime are slow acting and some become water soluble very quickly. Unless these factors are thoroughly understood by the farmer, his cost of production before harvest will, in 96% of 611 acres, be greater than it should be.

Potash may also be used to raise a pH. Potash also comes in many different forms. Sulphate 9 of potash, which is highly acid when first applied, is slow acting. Even though it is acid to begin with, the soil pH reading will rise somewhat above what it was at the time of application. Tobacco stems are slightly acid. From 85 to 120 days after tobacco stems are applied, the potash from the stems will meet its climax. In most annual crops this is too late to be of much benefit, because it was applied too late. When tobacco stems are to be used for a potash supplement, their application must be made at least 60 days before planting time and 90 days is preferable.

Hardwood ashes or just ashes are also used to sweeten soil and raise the pH. Here again there is a time and volume factor that should be determined by soil analysis. The maximum availability of potash from ashes is only about half the time required for tobacco stems, or forty to sixty days. Even though the breaking down of the ashes is much quicker, they should be applied at least 30 to 60 days before planting. THE SOIL CHEMISTRY OF pH IS VERY IMPORTANT AND EXTREMELY TECHNICAL. This is because all growth of all plants is regulated by alkali molecular action and all fruit production is brought about by acid molecular action. Alkalis make growth and acids make fruit. Anions make growth and cations make fruit. So alkalis, regardless of their source, will either increase or decrease your yield. It is a gamble when accurate chemical analyses are not predetermined, and in all too many cases a very costly one. No one today needs to take such a chance unless it is for the joy of gambling. There are pH readings that cannot be corrected by the addition of lime. There are

many fields with a low pH reading where great harm would be done by the addition of calcium. These fields have too much calcium already and to add more would do great harm. Metallic substances, such as iron, sulphur and aluminum, are often the culprits that give low pH readings in soil where there is already an over supply of water soluble calcium.

There are millions of cases when an application of lime in proportion to the cation nutrient resistance in soil compounds would give a great increase in yield and when the pH readings 10 were already ideal before the lime was applied. There are also many instances wherein potash added as the alkali or soil sweetener would have given a much better return than the addition of lime. Leaves are damaged by the addition of potash as an alkali when lime is needed and this damage all too often decreases yield. Soil tests in the hands of a physicist who is acquainted with plant requirements will show which form of alkali will give the greatest results, as well as the amounts to apply. Three hundred to four hundred percent increases in yield have often been harvested because the right kind and amount of an alkali or alkalis was applied in time to get the greatest benefit from them.

Calcium is the element that must be bought, distributed and applied by man and is most used in volume by plants. Maximum tonnage from any given area is absolutely determined on the amount of water soluble calcium. However, I have seen many cases in which calcium was added when sulphate of potash would have given a greater yield. This is due to the fact that the calcium was not in water soluble form and the acid in the sulphate of potash would have made the calcium available. Likewise I have seen many instances when potash was used to raise a pH reading when lime would have made a much greater yield. There are many times when either the calcium or the potash is present in sufficient amounts in the soil, but is not in a form available to plants. A pH reading does NOT indicate when lime or potash is needed.

A salesman, using a pH reading as his scientific guide to make sales for his products, needs more training than he has had. He can cite to you some of his successes - he could not stay in business unless he had some benefits to show -and he would not dare show anyone his failures. I am not insinuating that these men are dishonest. They are doing the best they know and at the same time doing about as much harm as good. In a greater percentage of cases they try to sell you more dolomite lime when the pH is already ideal and not denoting any calcium deficiency. Just to play it safe people are prone to forget their failures. A pH reading salesman will not exert himself to really 11 supply your hurting demands for calcium or potash, increase your tonnage of sales and your marketable tonnage unless you demand more marketable produce results from him. He will be wasting your time, as well as his, in most cases by showing you John Doe's farm where lime was applied. Your soil problems are different from John Doe's. The things that work on Mr. Doe's farm may or may not work on your farm. This same salesman can, no doubt, show you charts from the experiment station of results obtained by adding lime. The time it takes to read such charts, in most cases, is time wasted because those tests fail to tell how much water soluble calcium or acids were present at the time the tests were made. A pH Reading Test proves nothing. No true scientific conclusions can be drawn from it that will unquestionably fit your farm soil needs. People have a tendency to believe the printed page and, too often, read into it things they wish to hear, rather than the actual scientific message contained in it. There are others who have their minds made up and do not wish to be confused with facts. These men cannot be helped until they are about to lose all they have, and then some who are wise will grasp at anything that offers hope. There are too many cases that will go down in failure because they do not believe this report.

The pH reading salesman is doing some good, but only a trifle of what he really is capable of doing for you and for himself with only a little more training. If he would spend the time on your farm that he used in showing you John Doe's farm.jand if he would have diagnosed your water soluble calcium and potash needs by chemical quantitative tests based on the supply of available plant food energy requirements against the products he is selling, he would make a much greater profit for himself and all concerned. He would not make as many calls per day, but would sell more tonnage and render a greater service to you and to his company.

Builders white, lake-bottom sand has a pH reading of 7.00 with no acid cations or anions (lime or potash in any form) present that can give off plant food energy. All resistance has ceased because 12 the cation and anion resistance is equal in the element silicate. Pure sand has electrons in motion in the solid state moving at approximately the same speed as the compound water; therefore, it also has a pH reading of 7.00 with neither cations nor anions present that re capable of releasing plant food energy by itself. Fifty pounds of pure calcium added to a ton of dry, white sand will raise the pH reading to about 10.00. Two pounds of superphosphate to a ton of pure, dry sand, evenly mixed, will give a pH reading of about 4.00. Fifty pounds of pure calcium and two pounds of superphosphate when added to a ton of pure white, dry sand give a pH reading near 7.00. External temperatures will have some slight bearing on this experiment and for this reason these calculations are not absolute. Unless

the cation nutrient and the anion nutrient content potential of your soil is known, a great amount of damage can be done by adding too much acid or alkali, either as a soil conditioner or as a filler in fertilizers. Many times the cutting of a cover crop can thus excite the soil.

An idea is prevalent that if a little of something does good, then one should double the amount and get still greater benefits. This is an erroneous idea. Many times, for the same reason, too much lime or fertilizer is applied at one time and great damage is done by tying up plant food nutrients which would otherwise be available plant food.

Soil testing made by trained soil personnel will show how much acid or alkali fertilizer the soil requires to produce a maximum yield in a given time. A soil physicist can diagnose this soil test reading and recommend the fertilizers in forms that will give on the amount of energy required by plants to produce an abundant harvest.

A soil physicist, to be trusted by one, should be able to accurately calculate ones yield by the amount of plant food energy present in the soil as well as what can be added to the soil. He should be able to quote what the cost of production will be on a per unit basis. He will expect certain definite chemical changes to come about in the soil chemistry in a given number of days and should systematically analyze it to see that best results are obtained by his calculation at the time of the 13 first soil testing. Crops which require months to mature need to have the nutrient energy released at a much slower rate than crops which require only a few weeks until harvest is over. This energy release should increase as the demands for more energy are needed for the growing crop. Almost any person with a knowledge of farming can learn how to supply his soil requirements with sixty hours of classroom training in this particular field. The same can be said of the fertilizer or lime salesman. He can learn during the training period how to find out and determine which elements are needed as well as how much to apply, and when. He should also be able to predict with accuracy the release of the plant food energy and to accurately determine the marketable yield and the cost per marketable unit. When recommendations are made in this manner, a greater benefit for everyone will be realized, as well as a superior quality of foods.

SOIL TEST METHODS

The total amount of calcium or potash found in soils by flame photometer soil test methods means very little. This is because the total amount of elements present in the soil has very little to do with the available amounts. The available amounts of plant food energy can be accurately measured only by liquid soil test methods. The cation nutrient and anion nutrient molecular count can be tabulated toxiccurately predict the timing of the release of the plant food energy. This can be done so that more fertilizer can be added before all the piant food energy is used and any damage is done. DIRECT PLANT FOOD ENERGY CANNOT BE ACCURATELY CALCULATED BY FLAME PHOTOMETER SOIL TEST ANALYSIS. Then, you might ask, why is this soil test lethod used? The answer is that it is a quick and very cheap method of making soil tests. This kind of test is better than nothing at all, but it falls far short of what other test methods could do for persons involved.

All soil solvent testing reagents that are foreign to what is available in the soil should not be 14 used They are unreliable for the same reason that the flame photometer is unreliable. Where could plants go to get alcohol or carbon disulfide to dissolve the oxidized plant food? These are common reagents used in most laboratories, especially those operated by fertilizer companies and state laboratories. Such a soil test is more of a gimmick than a science. Their test was developed for mining purposes. They could sell you more fertilizer for cash if other methods of soil testing were used. This is because you would have a greater margin of profit and losses would be unknown. One of the problems faced by fertilizer companies is to sell one only the fertilizer that he will be able to pay for. This is good business for all. The fertilizer companies are not really to blame for this soil testing situation as much as the farmers who are demanding more service from these companies. In too many cases, the fertilizer companies are forced to buy the cheapest ingredients that they know are wrong for one's needs. The salesman knows that if he does not sell the fertilizer requested by the farmer, at the price that he will pay, then someone else will. So why should he refuse the sale regardless of the final result?

Farmers who ask for blanket bids for fertilizers without giving the exact amount of each ingredient are asking for trouble. There are thousands of ways to make up any number of NPK formulas, such as 6-6-6, or any other three numbers one wishes to choose that can be mixed. There are only 100 units in any ton of fertilizer (20 lbs. = 1 unit). The percentage of NPK (Nitrogen, Phosphate, Potash) make up these numbers. Ingredients from which they are derived vary widely. There are more than 190 sources of nitrogen, about 100 sources of phosphate and some 50 different sources of potash. The percentage of these elements determines the NPK percentages and also limits the NPK percen-

tage in any given ton. Suppose other farmers wishes to make a ton of 10-10-10 fertilizer and used castor pomace as the only source of nitrogen. This cannot be done because castor pomace contains about 6% nitrogen. The farmer would be short 4 units of nitrogen, about 8 units of phosphate and 15
6 units of potash. What does all this mean? It means that all these fertilizers will probably have a different pH. Some will be acid, some will be alkali and some will be neutral. An acid fertilizer when applied to the soil may remain acid, become an alkali and sometimes many become neutral, which is undesirable. An alkali fertilizer may remain an alkali or become neutral, both of which are undesirable. It may, however, become an acid or move in that direction. This is desirable because as each (acid or alkali) moves toward the opposite side, plant food energy is being given off. Plants cannot grow without it.

Fertilizer companies have learned that, in mixing fertilizers, it is safer for them to mix either all acid fertilizers or all alkali fertilizers in batches so that the ingredients will not set up, melt or start a fire. The very action that they seek to avoid in the mixed fertilizers is the action that is the most desirable in the soil. The cation versus anion action that would cause the fertilizer to set up and become hard as a rock, wherein pickers or a ahmmer mill would have to be used to spread it, when applied to the soil will cause the soil to become mellow and pliable. The chemical action will give off heat and carbon dioxide, which mellows soil. Knowing the pH of the fertilizer without knowing the effects the soil will have upon it is almost worthless.

There are some plain dirt farmers who do know what they need. They seem to be in tune with the soil. These are the progressive farmers who follow good farming practices and they use all the scientific knowledge that is available to them. The progressive farmer knows that when he follows certain scientific practices, he can predict his yield by the amount of applied fertilizers. Many farmers now use the best soil testing equipment they can buy to help them determine their soil needs. The only fault about this is the instruction that comes with these soil test kits. They do not go into enough detail for the farmer to accurately calculate the release and the timing of the plant food energy. It is easy to apply too much of something, or not enough, by using the instruction methods that come 16
with the do-it-yourself soil test kits. Such practices are as feasible as buying medical equipment with a book of instructions that tell you how to be a physician. The farmers could be greatly benefited by taking a course in plant food diagnostics.

Colloidal materials in the soil samples often cloud the readings until they are difficult to read accurately. A little instruction would get you over this hurdle. The colloidal content of the soil also affects the pH reading of sandy soils. The colloids in the soil are very important and must not be overlooked. Colloids are insoluble and without them there would be no life upon this planet. They mean more^to the soil chemistry than jewels do to one's watch. THE MAGNETISM CREATED BY THE ADDITION OF FERTILIZERS TO THE CATION AND ANION ELEMENTARY* AS WELL AS COMPOUND* SUBSTANCES IN THE SOIL BRING ABOUT A RESISTANCE WHICH* WHEN MEASURED* IS A pH READING. The pH reading is nothing more than this. It is what it is because of this resistance plus or minus the amount of external heat or cold present at the time. The pH should be higher during the growing season, and gradually lower as the harvest season approaches. This method will greatly increase the yield as anion nutrients give growth and volume and cation nutrients make fruit. Sucrose is the staff of life for plants as bread is for man. This same process delays the release of energy and permits a greater and greater release of plant food energy as the crops grow. The demand for more plant food is ever-present and is the absolute determining factor toward greater yields. This kind of pH control cannot be obtained by pH reading because the readings are a result of soil phenomenon, rather than a cause. Only soil tests which give a basic mathematical quantitative can give pH control. Anion and cation nutrient count derived from water-soluble and suspendable nutrient elements plus the addition of the most appropriate fertilizers, which were predetermined by soil tests, can create the best soil conditions. This causes the pH reading to be at the right time, so as to release the amount of plant food energy needed by plants during the growing season and give 17
maximum yields.

When soil temperatures are constantly too warm (over 90 degrees F. summer heat) then the pH readings are lower. This denotes a much faster release of plant food energy. In fact, so much plant food energy is being released and lost that the crops are unable to continue growing as they should. The speed of the electrons is too great to be held by the magnetic attraction of the rootlets. The soil temperatures can be controlled by using cations in ammoniacal form. Crops grow best when the soil temperatures are between 78 and 90 degrees F. in the upper six inches of the topsoil. The pH readings vary in direct proportion to the mathematical ratio of the cation and anion ratio in the soil plus the amount of heat generated by the summer sun.

The soil pH reading should go down at night and up in the day, as there is less heat interference at night. The soil should readily give up the heat during the summer nights, but only too often this does

not happen. The soil should retain this heat in the late fall and winter. As the pH reading goes down, less plant food energy is released and the electron energy is slowed down so it can be taken in by the magnetic attraction of the rootlets. Therefore, the vegetation grows more at night between the hours of 2:00 a.m. and 8:00 a.m. than at any other time of the day during the late spring, summer and early fall. The energy that is released in the daylight heat is cooled and slows down. It, therefore, has greater magnetic attraction even though the speed of the electrons in the molecule has been increased. It is only the released and escaping energy that is lost and is causing all the confusion in the soil. Unless one keeps in mind the two separate kinds of heat, one which the sun generates and the other which the cationand anion resistance creates, this can be very confusing. Ionic heat, in the North Temperature Zone, is only a small fraction of the heat compared to that which the sun generates in the soil. Plants grow best when the soil conditions are most favorable. Plants grow slower in the soils which constantly retain too much heat through the night than they do in soils which release the excessive heat readily. Soils which hold too much heat in the fall of the year cause 18
slower maturity and decrease yield. Too much water soluble calcium, potash and chlorine cause the anion nutrient molecular count to be too high in the soil at this time of year, which causes the crop to have a lower yield.

A warm winter will cause a lower yield unless the cation nutrient count is mechanically controlled. Cool weather causes an increase in cation nutrient action and a decrease in anion nutrient action. As the cation nutrients make fruit, nothing should be permitted to interfere with their action. A soil physicist can recommend fertilizers which will bring about the change-over from the anion nutrient side to the cation nutrient regardless of weather conditions. They can determine the plant food energy flow so that the anion nutrient energy will run out in late September in the North Temperate Zone and in March in the South Temperate Zone. As soon as the anion nutrients run out, the cation nutrients will begin manufacturing fruit in the crop regardless if the weather is cool or not.

The higher the sucrose content of the fruit or vegetable crop, the lower the freezing point. When fruit freezes and the sucrose turns to alcohol, the fruit is headed for skid row rather than the farmers market.

The pH readings are the result of the flow of electrical current in the soil and consequently mean nothing unless this flow can be made to flow as and when needed to increase the tonnage and the yield. This current flows toward the north. For this reason, the mariner's compass points toward the magnetic field in Canada. In the Eastern Standard Time Zone, magnetic north and true north are almost the same. THE CONDUCTIVITY OF THE ELEMENTS AND COMPOUNDS IN THE SOIL PLUS OR MINUS THE TEMPERATURE READINGS IS THE pH OF THE SOIL. The pH readings are to the soil what the speedometer is to an automobile. Both show speed. The pH readings show speed by a decrease in numbers and the speedometer shows speed by an increase in numerical values. Both denote resistance. A car travels faster with a tail wind than it does with the same acceleration and a head wind of the same magnitude 19

One cannot diagnose the mechanical ailments of an automobile by the speedometer reading any more than he can analyze the soil problems by pH readings. The speedometer may or may not denote serious mechanical troubles. The pH readings can do no more for one than the speedometer does for him in diagnosing his car's trouble. Would anyone trust the repair of his car to a mechanic who entertained such an idea?

We trust the supply of plant food energy of our soil to a soil mechanic who does just this. There is a difference between a mechanic and a mechanical physicist. A mechanic can make repairs. He does not know how to figure out ratio, torque, tensile strength, expansion and contraction brought about by temperature changes and finally - horsepower and speed. A mechanical physicist could very easily do mechanical work with just a few days' practice, but it would take years of training for a mechanic to become a mechanical physicist. The same is true in regard to scientific soil engineering. Laboratory technicians are not physicists. No physicist worth his salt would continually work as a laboratory technician. Many laboratory technicians would have us believe they are dependable physicists. One quick way to find out is to ask them to show us or tell us how to figure the plant food energy in one pound of any fertilizer we wish to name. If they cannot do this when the percentage is given, they certainly cannot accurately calculate the energy in anything whgn it is not given, even though they are able to measure it quantitively. A PHYSICIST MAY DO LABORATORY TECHNICIAN'S WORK, BUT A LABORATORY TECHNICIAN CANNOT DO THE WORK OF A PHYSICIST UNLESS HE OR SHE IS A PHYSICIST. Another way to tell if a technician is a physicist is to ask his opinion of this treatise. If he is a technician, he will condemn it or point out errors in it. If he is a real physicist, he will say that he believes the author has a point and he will do all in his power to learn more about it.

Our net profits are based on very unscientific methods if we are using a pH as a correctional 20
method for our soils. I have a shelf of books on pH readings. I have carefully read and studied them

all, and not one of these books teaches anyone how to predetermine the plant food energy which, in the end, results in a pH reading. Our future as farmers is absolutely dependent upon whether we control the pH readings of our soil or whether we just take a gamble and leave it to chance by continuing costly guessing. We must control our pH readings, or our pH readings will control us.

My suggestion is to read this article slowly. It is not possible, in writing this kind of information, to always give the information in sequence. Consequently, some of the facts will, at first, seem scattered rather than collective. To a certain extent they are scattered, but that is the way Nature established soil phenomena. Any questions will be appreciated. Please send $3.00 for each question to cover handling charges. If I cannot answer your questions, I will return your money.