Electro-Culture
(The Electrical Tickle)

Robert A. Nelson

1. Introduction

2. Antennas

3. Electrostatics

4. DC

5. AC

6. Magnetism

7. Electrogenics

8. Sound

9. Monochrome & Pulsed Light

10. References

1. Introduction

The application of electricity, magnetism, monochrome light, and sound can stimulate the growth of plants to a great extent. This little-known technology, called Electro-culture, can accelerate growth rates, increase yields, and improve crop quality. Electro-culture can protect plants from diseases, insects and frost. These methods also can reduce the requirements for fertilizer or pesticides. Farmers can grow bigger and better crops in less time, with less effort, and at a lower cost.

The several approaches to Electro-culture include: antennas, static electricity, direct and alternating current, magnetism, radio frequencies, monochrome and intermittent lighting, and sound. The energies are applied to the seeds, plants, soil or the water and nutrients.

2. Antenna Systems

The French farmer Justin Christofloreau attracted attention in 1925 with his apparatus to collect atmospheric energy for his crops. Clover treated by his method grew 7 feet high. Christofloreau's apparatus consisted of a 25-ft wooden pole; at the top was a metal pointer aligned north-south, and an antenna. Copper and zinc strips were soldered together to generate electricity from solar heat. Several of the poles were set about 10 ft apart, and the wires leading from them extended about 1000 yards. Christofloreau claimed that the accumulated electricity destroyed parasites and promoted beneficial chemical processes in the soil.(2)

In 1924, Georges Lakhovsky devised his Oscillator Circuit, a one-turn copper coil with overlapping ends separated by a gap. Capacitance generates oscillating currents that benefit the plants. The ring is supported by an insulator such as a plastic rod. This extremely simple arrangement stimulates plant growth (Fig. 5.1). (3)

Other configurations also enhance plant growth. A conical coil of stiff wire wound with 9 turns (counter-clockwise in the Northern Hemisphere, clockwise in the Southern), when stuck in the ground about 1 ft north of a plant, will collect atmospheric electricity. Connect a wire from the fence to a metal rod near the plants. A tv antenna also can be used. Rebar can be sunk into the ground at each end of a row of plants, connected by a bare wire under the soil and/or in the air. A north-south orientation will take advantage of geomagnetic polarity.

3. Electrostatic Systems

Experimental study of the effects of electricity on plant growth began in 1746, when Dr. Maimbray of Edinburg treated myrtle plants with the output of an electrostatic generator, thereby enhancing their growth and flowering. Two years later, the French abbot Jean Nolet found that plants respond with accelerated rates of germination and overall growth when cultivated under charged electrodes.

Beginning in 1885, the Finnish scientist Selim Laemstrom experimented with an aerial system powered by a Wimhurst generator and Leyden jars. He found that the electrical discharge from wire points stimulated the growth of crops such as potatoes, carrots, and celery for an average increase of about 40% (up to 70%) within 8 weeks. Greenhouse-grown strawberry plants produced ripe fruit in half the usual time. The yield of raspberries was increased by 95%, and the yield of carrots was increased by 125%. However, crops of cabbage, turnips, and flax grew better without electrification than with it. The Laemstrom system comprises a horizontal antenna suspended high enough to permit plowing, weeding and irrigation. The voltage applied to the antenna varies from 2 to 70 KV, depending on the height of the antenna. The current is about 11 amps. (4, 5)

Spechniew and Bertholon obtained similar results a few years later, and so did the Swiss priest J.J. Gasner in 1909. Also that year, Prof. G. Stone showed that a few sparks of static electricity discharged into the soil each day increased soil bacteria up to 600%.

In the 1920s, V.H. Blackman reported his experiments with an aerial system similar to that of Laemstrom. He applied 60 volts DC/1 milliamp through 3 steel wires each 32 ft long and suspended 6 ft apart and 7 ft high on poles. This arrangement yielded an average increase of about 50% for several plant types. (6)

In 1898, Grandeau and Leclerq studied the effect of atmospheric electricity on plants by covering part of a field with a wire net which shielded them from natural electrical action. The uncovered plants grew 50-60% better than the shielded plants.

Wet soil improves current flow. Electro-cultured plants require about 10% more water than control plants because the charged water is perspired more rapidly than under normal conditions. Positive results are always obtained except when ozone is formed by ionization. Negative aero-ions intensify cellular oxidation reduction processes, while the positives depress them.

4. Direct Current

In the 1840s, W. Ross of New York reportedly obtained a severalfold increase in the yield of a field of potatoes when he buried a copper plate (5 ft x 14 ft) in the earth, and a zinc plate of the same dimensions 200 ft away. The two plates were connected by a wire above ground, thus forming a galvanic cell. In similar experiments by Holdenfleiss (1844) with battery-charged zinc and copper plates, yields increased up to 25%.(7)

From 1918 to 1921 some 500 British farmers developed a shared system to treat their grain in an electrified solution of nutrients. The grain was dried before sowing. The farmers cultivated about

2,000 acres with the seed. The results were reported in Scientific American (15 February 1919):

"In the first place, there is a notable increase in the yield of grain from electrified seed... the yield of the electrified seed exceeds that of the unelectrified by from 4 to 16 bushels... The average... is between 25 and 30 % of increase... The increase in weight has ranged from 1 pound to as much as 4 pounds per bushel... Besides the increase in the bulk of the yield and the increase in the weight per bushel, there is an increase in the straw... whereas the bulk of the unelectrified seeds had thrown up only 2 straws per seed, the electrified had thrown up 5.... The straw growing from the electrified seed is longer... The stoutness and the strength of the straw is increased... the crop is less likely to be laid by storms... Corn growing from seed thus treated is less susceptible to the attacks of fungus diseases and wireworm.

"The effect produced upon the seed is not permanent; it will retain its enhanced efficiency only for about a month after electrification, if kept in a dry place. It is therefore desirable that the seed be sown promptly after it has been electrified... The grain must be steeped in water that contains in solution some salt [sodium nitrite] that will act as a conductor... The seed is steeped in it, and a weak current of electricity is passed by means of [iron] electrodes of large surface attached to two opposite end walls of the tank. The seed is then taken out and dried.

"Seed that is to be sown on one kind of soil will yield better results with a calcium salt, and seed that is to be sown on another kind of soil will yield better results with a sodium or other salt. One kind of seed will need treatment for so many hours, and another kind for many hours more or fewer. Barley, for instance, needs twice as long treatment as wheat or oats. The strength of the solution and the strength of the current must be appropriate, and are not necessarily the same in each case. The drying is very important. The seed must be dried at the right temperature, neither too rapidly nor too slowly; and it must be dried to the right degree, neither too much or too little." (8, 9)

In 1964, the USDA performed tests in which a negative electrode was placed high in a tree, and the positive electrode was connected to a nail driven into the base of the tree. Stimulation with 60 volts DC substantially increased leaf density on electrified branches after a month. Within a year, foliage increased 300% on those branches! (10)

Electricity also can cure trees of some diseases. A method was developed in 1966 to treat avocado trees affected with canker and orange trees with scaly bark. An electrode was inserted into the living cambium and phloem layers of the tree and the current passed into the branches, roots or soil. The treatment is best administered in the spring. The length of treatment depends on the size and condition of the tree. New shoots appeared after only one cycle of treatment. After the bark was removed, the trees began to bear fruit! The period of grafting stratification also can be shortened in this way.

The passage of an electric current modifies the physico-chemical properties of soil. Its aggregation increases, and its permeability to moisture improves. The content of absorbable nitrogen, phosphorus, and other substances is increased. The pH changes. Usually, alkalinity is reduced, and evaporation increases. Both alternating and direct electric currents have a bacterial action which also affects the soil microflora. Up to 95% of cabbage mildew and other bacteria and fungi can be destroyed by electrical disinfection.

Brief exposure of seeds to electric current ends their dormancy, accelerates development throughout the period of vegetation, and ultimately increases yields. The effect is greater with seeds that have a low rate of germination. The metabolism of seedlings is stimulated; respiration and hydrolytic enzyme activity is intensified for many types of plants. Lazarenko and Gorbatovskaya reported these results:

"Reports that the characteristics acquired by the plants in electrically treated soils are transmitted by inheritance to the third generation are particularly interesting.

"Under the influence of the electrical current, the numerical proportions between hemp plants of different sexes was changed by comparison with the control to give an increased number of female plants by 20-25%, in connection with a reduction in the intensity of the oxidative processes in the plant tissues."

"At the end of vegetation the experimental cotton plant possessed twice or three times as many pods as the control plant. The mean weight of the seeds and fiber was greater in the experimental plants also. In the case of sugar beet the yield and sugar content were increased, and in places near the negative pole the increase in sugar content was particularly high. The tomato yield increased by 10-30%, and the chemical composition of the fruit was modified. The chlorophyll content of these plants was always greater than that of the control... Corn plants absorbed twice as much nitrogen as control plants during the vegetative period... The transpiration of the experimental plant was higher than that of the control, especially in the evening...

"The stimulating action of the alternating current was greatest when the current with density of 0.5 mA/sq cm... A direct current with density of 0.01 mA/sq cm had approximately the same action. When these optimal current densities were used in hotbeds, the yield of green mass could be increased by 40%." (1)

P.V. Kravtsov, et al., reported that the population of ammonifying bacteria (especially the sporogenous type) increases about 150% when soil or compost is exposed to continuous low-power DC. The symbiotic activity of nodule bacteria with bean plants was characterized by massive nodules near the base of the root. Field experiments were conducted on 40 hectares. The peas treated with electrified inoculant produced 34% more yield than a control crop. Carbon dioxide evolution in the soil increased over 35%. The authors also reported that treatment of seed with electric-spark discharge destroys microflora and activates the germination process. (11)

An electrified fence was invented by Henry T. Burkey in 1947 to keep fish out of irrigation ditches. The fence consisted of a free-swinging row of electrodes connected to a generator which slightly charged the water to shock fish without hurting them.(12)

5.
Alternating Current

When using AC, great care must be taken to prevent electrocution of oneself and the plants. AC generally tends to retard plant growth except within certain narrow parameters of voltage and amperage. Dicotyledon plants increase in weight at 10 KV and 100 KV, but decrease in weight (as much as 45%) between 20 to 60 KV. Current must be very low, or plant growth will be retarded.

L.E. Murr used aluminum wire mesh electrodes charged up to 60 KV, and found that monocotyledons increase in dry weight in an electrostatic (ES) field, but decrease in weight in an oscillating field. The dry weight of dicots increases about 20% when grown in an oscillating field, but decreases above 50 KV. The concentration of minor elements (Fe, Zn, Al) increases several hundred percent in active leaf tips, due to an increase in oligo-enzymes. The activity of these substances is accelerated so much that cellular respiration is impeded, resulting in deterioration and death. There appears to be no benefit from continual exposure of plants to an alternating electrical field. If such a system is used, voltages should not exceed 10 KV, and the current must be very weak.(13-15)

However, the results can be worthwhile. In a similar system, the maximum energy supplied was 50 watts (50 KV/1 mA) per acre for 6 hours daily for 6 months. The total energy supplied was less than 0.2% of the energy actually absorbed by the plants from sunlight alone. Only a fraction of this additional energy was available to the plants, yet the increase averaged above 20%, up to 50%! Furthermore, it was found that an electrical discharge applied during the first month of the growing season may be as effective as continued treatment throughout the season.

In November 1927 and January 1928, Popular Science Monthly announced H. L. Roe’s invention of an electrified plow which sent 103 KV between the plow shares to kill pests in the soil. In 1939, Fred Opp invented a garden cultivator that used high-tension electric current to increase the nitrogen content of the soil. The system was described in Popular Science Monthly (October 1939):

"A generator with an output of 110 volts AC, a storage battery for exciting the armature field, and a transformer that steps up the current to 15 KV... [is] mounted on a walking-type garden tractor equipped with a small gasoline motor that drives both the tractor and the generator. Current is conducted through a pair of electrodes to furrows in the soil made by a cultivator. As the electrodes are dragged along, soil falls on top of them, making the contact"

The same method was incorporated into the "Electrovator" built by Gilbert M. Baker, as reported in Popular Science (September 1946):

"It is a trailer containing a... 12.5 KVA generator and a special transformer. Two rakes with copper electrodes for teeth apply the high-voltage, low-amperage current to weeds as the machine is drawn at 1 mph... The weeds burn, from the tops to root-tips, leaving the land ready for new crops. The treatment can be repeated for successive growth."

In 1911, Emilio Olsson patented an irrigation system using electrified rain. The water was contained in an insulated iron tank, positively charge with 110 V/0.5 A. The negative pole was insulated copper wire, stripped bare at the tip. The sprinklers were mounted 5 meters high. Olsson successfully cultivated a 600-acre plantation with this method. The city of Buenos Aires adopted the system for use in its parks.(16)

The treatment of seeds in an electric field before sowing gives a consistent increase in yield, usually about 15-20%. L.A. Azin and F.Y. Izakov reported these results of their research:

"The electric field of the corona discharge differs from the electrostatic field by possessing considerable homogeneity and by the precession of space charges of the same sign in its working zone. Because of this any particle, including a seed, receives a charge of the same sign in such a field. The [ES] field is homogenous and does not possess space charges, although charging may take place here because a seed, if placed on the metal electrode, acquired a charge by contact, corresponding in its sign to the polarity of the electrode."

N.F. Kozhevnikova and S.A. Stanko experimented with AC effects. They found:

"After treatment in optimal conditions, the yield of green mass is increased by 10-30%, and the yield of grain by 10-20%. Besides the increased yield, treatment of seeds with an alternating current may improve other economically valuable properties of cultivated crops: the leaf cover of the plants may be increased, the vegetative period may be shortened, the absolute weight of the grain may be increased, and so on..."

The seeds were treated with 2-4 KV/cm, with 8 KV on the electrodes of the working chamber. Exposure was for 30 seconds, or for 1 hour. It was found that if treated seeds were kept for 10-17 days before sowing, the mature plants would contain up to 86% more chlorophyll and 50% more carotenoids than the controls! (17)

B.R. Lazarencko and J.B. Gorbatovska reported similar results achieved under various conditions of corona discharge treatments of seeds:

"After electric treatment of this type, an increase in their germination rate and, in particular, in the energy of germination was observed. The improvement was especially marked in the properties of seeds located on the negative electrode during treatment. In this case an increase in yield of 2-6 centners/hectare was obtained with nearly all the conditions of treatment used. The increase in yield was smaller for plants whose seeds were treated on the positive electrode. Corn seeds, treated in a constant electric field, gave good yields which developed rapidly. Green tomatoes ripen faster if they are placed in an electric field close to the positive electrode or between the poles of a magnet, especially close to the south pole.

The viability and the fertilizing power of the pollen at first increased and then decreased as the duration of its treatment in a constant electric field was lengthened. In optimal conditions this fertilizing power was increased from twice to four times. The use of high voltage electric fields for the treatment of pollen has led to the modification of its bioelectrical properties and has made it possible to influence the fertilization process: the setting rate of fruit has been increased during hybridization of varieties of more distant forms, and the failure to cross distant species of fruiting plants has been overcome. (18)

Seed-borne bacteria, fungi and insects can be destroyed without injuring the seeds, by application of high-frequency ES fields between capacitor plates. Pests are destroyed when a lethal degree of heat is developed within a few seconds. A longer exposure is required to cause decreased germination of seeds than is necessary to kill pests. (19, 20)

By this same method, it is possible to increase the power of germination of old seeds or seeds which are naturally difficult to germinate. Starch is increased, invert sugar is increased, and albumin is changed by such treatment. A greater percentage of treated seeds sprout sooner than untreated seeds. High-frequency ES fields also can be used either to inactivate or enhance enzymatic metabolism of fruits and vegetables, thus prolonging their stability, or hastening their ripening. In an ES field of 36 KV/m, the negative pole positioned above the seeds enhances their germination. The positive pole above the seeds inhibits germination. In the 1930s, V. Lebedev used very low power ultrashort waves to irradiate seeds, resulting in 20-45% accelerated plant growth. Similar results were obtained with potato tubers, and gladiolus bulbs were grown without cold pre-treatment.

The effects are thought to be caused by conduction currents or dipole antenna resonance. The lethal effect begins at about 10.4 meters wavelength (29 MHz) when the condensor plates are 2-3 cm apart. Other researchers have reported similar effects with the following parameters: Plates, 12 cm diam.; Current, 5.5 amps; Wavelength, 5.6 meters (50 MHz); Temperature, 30-40^{o} C. The lethal effects depend on the wavelength and the voltage gradient of the field strength (the distance between the condensor plates). Increasing either the frequency or the field strength while other factors remain constant increases the speed of the effect on pests. An increase of either factor requires more current, yet at certain frequencies (around 3 MHz), much less current is required for effective results (about 4 KV per linear inch). The higher the frequency, the shorter the lethal time. The thickness of the seeds and their moisture content also changes a lethal dose. The temperature of the seeds and pests may rise up to 60^{o} C. A similar method was developed to destroy termites in wood, using a 20 MHz signal for the purpose.

Experiments conducted by H. Kronig showed that after a week of development, seeds exposed to extremely low frequency (0.5-20 Hz) fields, wheat seeds grew an average of 23% greater length than non-electrified controls.

Other experimenters have found that the high-frequency currents generated by a Tesla coil will protect plants from temperatures as low as 10^{o} F, which destroyed unprotected plants. (28)

In 1920, Thomas Curtis used a large, oil-immersed Tesla coil (10 KV/500 W) to supply high-tension current over a 200 sq ft plot planted with radishes and lettuce. The electrified crops were at least 50% larger than the normal crops.

6.
Magnetism

Plant breeder Alberto Pirovano published some 50 papers on inherited changes in plants which he induced by treatment with low frequency or constant magnetic fields.

Albert R. Davis received U.S. Patent #3,030,590 for his system of gardening with magnetism. Davis said:

"We found... that treating above ground seeds with the South Pole of a magnet [1,500-2,500 gauss] increases the germination and growth, and the leaves of these vegetables are larger.

"If you treat seeds [of]... beets, potatoes, carrots or turnips, you will produce a better result by using the North Pole of the magnet."

The magnetic influence also softens the surface tension of water, which then is more readily absorbed by the seeds and plants.

U.J. Pittmaan conducted extensive field experiments with these results:

"Earth’s magnetism can effect the direction of root growth of some plants, and also the growth rate of some seedlings... The roots of some plants [winter and spring wheat, and wild oats] normally align themselves in a N-S plane approximately parallel to the horizontal face of Earth’s magnetic field... Winter wheat seeded in rows running at right angles to the magnetic N often out-yield wheat seeded in other direction by 3-4 bushels/acre because the roots grow in a N-S direction and utilize nutrients in the inter-row areas more extensively.

"Seeds of some varieties of wheat, barley, flax, and rye were found to germinate faster and grow more during their seedling stages when their long axes and embryo ends are pointed toward the N magnetic pole than when they are pointed in any other direction.

"Many seeds germinate and grow about two times faster if they are exposed to the N pole of an artificial field before they are planted than they are not so treated ~ wheat seed in particular grows about 5 times as much in the first 48 hours as unexposed seed.

"In some species the enhanced growth rate persists through to maturity. Green snap beans thus mature more uniformly and yield more than those from untreated seed planted randomly.

"The effects of magnetic treatment before germination appear to remain active within some seeds for at least 18 months after application. The magnetic intensity required to give maximum response appears to be between 0.5 and 100 Oersted when applied for 240 hours. For some unknown reason a greater growth response occurs if the seeds are subjected to magnetism for 48, 144, 240, or 336 hours than if exposed for intermediate periods. An exposure for 240 hours produces maximum responses in most seeds..." (21)

Pittman discovered that the sexual determination of monoecious plants such as corn and cucumbers also is affected by the geomagnetic field:

"If the embryo radical of such plants is oriented toward the North, a greater number of female flowers is formed than in the case of seeds oriented toward the South. Since cucumber fruits are produced from the female flower, Northward orientation of the seed radicals will lead, of course, to greater yield per plant.

"In general, Northward orientation of the embryonic radical (particularly of corn) promotes masculinity. The response of seeds when oriented toward the geomagnetic poles depends on the left- or right-handedness of the seed and the sexual characteristics of the plant type. When oriented with the tip of the embryo radical towards the S geomagnetic pole, l-rotary seeds demonstrate higher rates of growth, respiration, and enzymatic activity, and up to 50% greater yields. D-rotary seeds respond with up to 50% enhanced growth rates and yields when their embryo tips are pointed at the N pole."

When conifer seeds are grown with their embryo radicals oriented S, they germinate 4-5 days earlier than seeds oriented toward the N pole. Lunar phases also have a profound effect on the germination of conifers. They will sprout much faster when their embryo radicals are oriented S during a full moon, than they will if germinated during the new moon.

If there is any doubt about the directivity or gender of seeds, positive results can be obtained in any case by treating seeds for 2 weeks in the magnetic null, the quiet region where the magnetic pull is balanced between N and S. This region is located by observing the patterns formed by iron powder scattered on a glass pane placed over the magnet.

Pittman also grew potatoes from excised, magnetically treated eyes. The field-grown crop yielded 17% more marketable tubers that weighed 38.5% more than those grown from untreated eyes! Pittman concluded:

"Pre-germination magnetic treatment of the eye may have effected a change in the metabolic process in the bud that eventually promoted earlier and greater tuber initiation. Tubers initiated early would have had more time to develop size than those initiated later.

"The exposure of seeds to magnetic fields also increases the percentage of germination of apricot and apple seeds, increases the yields of snap beans, accelerates the growth of legume and cereal seedlings, and the rate of tomato ripening."

P.W. Ssawsotin reported that a low intensity (60 Oe) field may affect some biological processes as much as high intensity (1,600 Oe) magnets. Some of the effective "windows" are quite narrow. Strevoka, et al., found that a field strength of 60 Oe increased the growth rate of beans, cucumbers, lupines, maize and rye, but the rye was unaffected by a 100 Oe field. The greatest results were obtained at the temperatures which are optimal for the growth of each type of plant. (22)

Other Russian researchers found that wheat and barley seeds pre-magnetized (2,000 Oe) for 30 minutes with the major axis aligned with the magnetic flux will germinate much more vigorously than control seeds. Germination actually is retarded when seeds are aligned against the flux. Corn seeds respond differently according to their left (l-) or right (d-) orientation or symmetry (s) when treated by a constant magnetic field (7 kOe) for 15 minutes. L-seeds are most responsive, showing increased potassium and water uptake and free amino acids 24 hours after treatment. The effect on l-seeds is strongest when the water-swollen embryo is oriented towards the N magnetic pole. Lazarenko and Gorbatovskaya also reported other strange effects:

"Even more curious results were yielded by experiments in which seeds were heated in a test tube left for 30 minutes in boiling water... Compared to the control seeds, the seeds heated (in the dry state described above) and exposed to the magnetic field exhibited greater sprouting activity..."

Other experiments have shown that treatment of soil with magnetized water and/or low-frequency current (0.5 or 5 A) activates soil potassium and phosphorus, thereby increasing their bioavailability. (23, 24)

A.V. Krylov also demonstrated magnetotropic phenomena in plants:

"Germination of seeds in a constant magnetic field accelerated growth of the shoots and rootlets and development of the plant, while an increase in its positive sign promoted aging, disease and death. Polarity also plays a role in plant immunity. Seedlings with their rootlets turned toward the N pole were thickly infested by parasites and molds, and the resistance of these seedlings was obviously depressed. The appearance of seedlings facing the S pole (with all other conditions the same) was completely different."

In a 1,500 Oe field, the largest number of germinating seeds was found after an exposure of 10-30 and 300 minutes. Other gains were found at 2,800 Oe. If the magnetic field is too intense, germination can be retarded. Strevoka reported a contrary finding: a non-homogenous 12,000 Oe field suppresses the germination of beans up to 40%.(25)

DeLand's Frost Guard ~ The "Frost Guard Tower" developed by John DeLand in the 1940s used magnetism to replace obnoxious smudge pots. He obtained high yields from orange trees formerly considered to be too old to be productive. The DeLand system can protect one acre of trees from frost, but it is ineffective for small plants. George van Tassel gave this description of the device:

"The DeLand Frost Guard Tower is about 32 feet high. It is composed of three 12-ft lengths of standard galvanized steel pipe. The lowest section is 2-inch pipe, set 3 ft deep in concrete. On top of this a 12-ft section of 1.5 inch pipe is screwed on by means of a reducer. Above this the top section of 12-foot pipe, 1-inch in diameter, is screwed on by means of a reducer. Resting horizontally atop each reducer and at the mast head is a 1-ft diameter disk of waterproof, 3/4-inch plywood. Near the outer diameter of each plywood disk or collar is drilled 7 holes. These holes are parallel to the center mast and are equally spaced around the diameter, 51-1/2 degrees apart.

"Beginning at the top of the mast, with an extension of 6 or 7 inches parallel to the ground, #10 gauge bare copper wires are run down through the concrete foundation's outer edge. From there they branch out, in 18-inch deep trenches, to a distance of not more than 144 ft from the mast's center. At this point, each wire is wrapped several times around an Alnico-V permanent magnet. The end of each wire is brought above ground and pointed back toward its corresponding other end on top of the tower. The magnet is given a coat of plastic to protect it from rust and to hold the windings in place.

"The trenches and magnets are covered with earth. The 18-inch depth is to protect the wires from cultivation, they must remain uncut if the system is to function. One wire on the tower, and hence in the earth, must point toward magnetic North. The placing of this first magnet must be done very accurately, and the others should be accurately placed.

"The magnet sets are inclined toward the mast at 34 degrees to the surface of the ground. Pointing the buried bar magnets toward the North magnetic pole, but also setting them so they point or tilt toward the central mast gives a skew to the flux or flow of energy.

"This system has protected groves when temperatures have fallen to as low as 20^{o} F. The system does not alter the air temperature in the grove. Rather, it seems to effect a condition in the plants themselves, so that lower temperatures will not induce freezing. Fruit laying on the ground will freeze, however." (26-28)

7.
Electrogenic Seed Treatment

In the 1970s, Andrew Zaderej and Claude Corson formed Intertec, Inc., to develop and market their "Electrogenic Seed Treatment", based on Zaderej's US Patent 4,302,670. A variety of atmospheric conditions are known to benefit plant development; the Intertec system simulates these. The seeds are conditioned and rejuvenated, resulting in more rapid germination and increased yields.

Seeds are sprayed with a solution of minerals and enzymes which is implanted into the seed coat by electrophoresis; this accelerates chromosomatic activity. A second exposure to high voltage negative ions increases the implantation. Then the seeds are exposed to infrared radiation in order to reduce the hard-seed dormancy and increase the metabolism of ATP.

The next stage uses an electrostatic charge to give cathodic protection. This reduces the mortality rate of seeds by providing a source of electrons to buffer the reaction with free-radical nutrient ions. Seeds must be moist when treated with cathodic protection. Dry seeds may be damaged by this treatment, but damaged seeds can be repaired somewhat if they are moistened. Cathodic protection increases viability and germination up to 200%.

The final stage of the Electrogenic process treats seeds with select radio frequencies which stress the memory of DNA molecules, charges the mitochondria, and intensifies other metabolic processes. This treatment increases the degree of water absorption, electrical conductivity, and oxygen uptake. The frequencies range from 800 KHz to 1.5 MHz with a field intensity of 3.2 W/sq cm.

The seeds need to be treated at or near where they are to be sown. For some unknown reason, the effects of Electrogenic treatment apparently do not travel well.

8. Sound

The growth of plants can be stimulated by sound alone. The effect continues up to 50 KHz. Frequencies of 4-5 KHz are particularly effective for increasing germination, enzyme activity, and respiration.

Normally, the streaming movement of protoplasm in plant cells slows down in the early morning and evening, but this streaming can be accelerated by an audio frequency generator used for 30 minutes at a distance of about 5 feet from the plants. As a result, the amount and rate of growth increases. Plants should not be treated thus for more than 3 hours daily, or the plants are likely to die within a month or two, depending on the quality of the sound and its intensity. Very loud, high frequency sound causes cellular disruption and death. Some rock'n roll music also does so.

A revolutionary process called "Sonic Bloom", invented by Dan Carlson, uses a 3 KHz tone (modulated to produce birdlike chirps and whistles) and a foliar spray (55 trace minerals, seaweed, gibberillin and amino acids) to produce "indeterminate growth in plants". His first success was with a Purple Passion house plant that normally grows only about 18 inches. Under the influence of Sonic Bloom, the plant eventually grew over 1,200 feet, and earned itself a place in the Guinness Book of World Records. (29)

Growers using Sonic Bloom report dramatic increases in yield, better tasting vegetables and fruits, and more brilliant flowers. Cultivators can expect increased production and early maturity. Alfalfa sprouts will increase in weight by 1,200% within 3 days. The sprouts will have a much longer shelf life (2-3 weeks) than usual (3-4 days). Experiments with Sonic Bloom in Africa produced plants which survived extremely hot weather and flooding. Sonic Bloom also will produce fruit on first year trees. Apple farmers have reported triple-sized yields, 8-month shelf life, and a huge increase in nutrient values: 126% more potassium, 326% more chromium, 400% more iron, and 1,750% more zinc. Losses to diseases and pests have been reduced more than 80%.

The possibilities are unlimited. For example, Carlson says:

"One of our greatest breakthroughs to make everyone understand how easy it is to feed large amounts of people, involved a sucker on a tomato. A sucker is normally a sterile branch which appears in between a side shoot and the main branch. Our tomato plants grow 2 inches a day so if we allow a sucker to grow for seven days, it's about 14 inches long. If we then cut it off, put it in the shade and spray it once a day with a 1/4 ounce per gallon solution of Sonic Bloom, in 10-14 days it becomes fully rooted and starts to grow 2 inches per day. Fifty-five days later, it is 7-9 feet tall. Now, normal production on tomatoes is 90 days. We're doing this in less than 55, plus we're producing at least twice as much fruit in almost half the time.

Water is added to the concentrated Sonic Bloom formula. The cassette (containing a 3 KHz signal and nature sounds) is played at high volume with high treble and medium bass for 10 minutes before spraying the plants. The plants are then sprayed while the cassette is playing, and the sound is continued for another 20 minutes after spraying. Both sides of the leaves should be saturated. Treatment is best performed early in the morning (before 9 am), preferably in foggy weather. On cold mornings, spraying should be delayed until late afternoon. Do not spray plants when the temperature falls below 50^{o} F. The formula also can be administered in the regular weather supply, by drip-feeding, hydroponics, etc.. The nutrient solution should be applied once a month for the first month, then twice weekly thereafter. Seeds should be soaked in dilute nutrient solution for 8 hours or overnight while the sound tape is played continuously on a cassette deck with auto-reverse capability. Plant the seeds immediately. The tape ought to be played daily for at least 30 minutes during daylight hours.

9. Monochrome & Pulsed Light

Plants respond to light with a complex variety of reactions that are affected by the duration (photoperiod), intensity, and wavelength of the light. During the 19th century, Edward Babbitt and others reported that the germination of seeds increases by 50% under the influence of blue light (provided by blue glass filters). Plant vitality is increased, growth is accelerated, stem and leaf development are improved, and yields are increased.

In 1861, General A.J. Pleasanton constructed a 2,200 sq ft greenhouse in which every eighth pane was blue. Pleasanton obtained phenomenal results in terms of increased yields, improved flavor, etc, and he received US Patent # 119,242 for "Improvements in Accelerating the Growth of Plants and

Animals." He recommended a ratio of white 8:1 blue light for optimal plant growth, and a ration of 1:1 for best animal development. Blue light stimulates the directional response of plants to light. Plants' pores open more widely in the presence of blue light (use it with Sonic Bloom). Evaporation and photosynthesis are intensified and chlorophyll production is accelerated. However, some cells may rupture, and mitosis may be inhibited.

The He-Ne laser (632.8 nm) can influence the phytochrome-controlled germination, growth and development of plants from a distance of more than a quarter-mile. The maximum effect is obtained by only 1 or 2 minutes of exposure to reflected laser light. More than 10 minutes of irradiation will inhibit the phytochrome response. In some cases, successive nightly irradiations of low intensity have a significantly greater effect than a single exposure of greater length or intensity. The response can be reversed by alternating exposure to laser and infrared light. (30-32)

G. Krustev, et al., investigated the effect of laser irradiation on hemp production, and determined that laser treatment improved the sowing qualities of the seeds, shortened the phases of plant development, produced more vigorous plants, and increased the yields of both stems and seeds to a considerable extent. The researchers used a He-Ne laser for 15 and 30 minutes, and a nitrogen laser with 225 and 450 impulses. (33)

Red light can be used to increase the growth of some plants (beans, etc.) up to ten times the normal rate by stimulating phytochrome activity. Red light at 660 nm stimulates growth, development, flowering, and fruiting. When red light at 700 nm is available with 650 nm red light, photosynthetic activity is considerably greater than with either single frequency. Blue light at 420 nm enhances the effect of 650 nm red light. Photosynthesis occurs at approximately 440 nm.

Photosynthesis can be increased up to 400% by means of intermittent light. The researchers used a rotating disk with a cut-out section to chop the light from a lamp. They found that 75% of the light from a given source could be blocked without decreasing the rate of photosynthesis. The improved yields produced by intermittent light depends on the frequency of the flashing. A frequency of 4 flashes/minute resulted in 100% increased yields. The amount of work done by the light can be increased by shortening both the light and dark periods. For example, yields can be increased 100% by using 133 flashes/second. Emerson and Williams improved the yield (compared to continuous light) by 400% by using only 50 flashes/second. The light flashes must be much shorter than the dark period. The minimum dark period is about 0.03 at 25^{o} C. The light reaction begins with about 0.001 second/flash, and it depends on the concentration of carbon dioxide.

A. Shakhov, et al., developed several methods of applying Concentrated Pulsed Sunlight (CPSL) to stimulate the photoenergetic activity of seeds and plants. The flashes of CPSL last from 0.2 to 1 second and produce significant effects on physiological processes and increase plant productivity. The CPSL effect is not caused by the thermal action of concentrated light, but by endowing plants with a "photoenergy reserve" that increases yields of vegetable crops by 20-30%, and grain crops by 5-10%.

Arrays of aluminum and glass dishes are used to concentrate sunlight up to 100 times. The apparatus is shaken lightly by various means to pulse the irradiation as it is directed on seeds or plants. In one such device, a large semi-conical aluminum reflector is rotated by a motor at 100-130 rpm. The seeds arrange themselves in a single layer on the wall of the pan and receive intermittent irradiation as they pass through a fixed focal spot on the inside wall. Artificial lighting (70,000 lux) pulsed 120 flashes/min. was found to produce effects even though the light energy was much lower than that of CPSL. With duckweed, maximum growth was obtained with a pulse period of 0.004 second.

Another system uses tinted mirrors to produce single colors. S.A. Stanko irradiated soy plants with pulsed red light for 30 min/day for a week, resulting in a 8% increase in the protein content of the beans.

Thomas G. Hieronymous discovered that a plant can be grown in complete darkness indoors if it is connected by an insulated wire to a large metal surface that is exposed to sunlight. The plant must be at least 6 feet above ground and insulated to generate a voltage potential or antenna effect. The optimal size of the metal sheet must be determined by experiment so as to avoid sunburn (too large) or yellowing (too small). Plants cultivated in this manner will develop normally, while control plants will be stunted.

Dr. Wilhelm Reich (of Orgone fame) also found that plants could be grown without light if they were grown with magnetite that had been exposed to sunlight. The magnetite absorbs and reradiates solar energies that are utilized by plants.

10.
References

1.Lazarenko, B. & Gorbatovskaya, J.: Applied Electrical Phenomena #6 (March-April 1966)
2.Gradenwitz, Alfred: Popular Science Monthly (June 1925)
3. Lakhovsky, G.: The Secret of Life; 1939, W. Heinemann, London
4. Briggs, Lyman, et al.: USDA Departmental Bulletin #1379 (January 1926)
5. Scientific American (10 June 1905)
6. Blackmann, V.H.: J. Agric. Sci. 14: 120-186 (1924)
7. Ross, W.: U.S. Commissioner of Patents Report 27: 370 (1844)
8. Sci. Amer. (15 Feb. 1920), pp. 142-143
9. Practical Electrics (Nov. 1921)
10. Moore, A.D.: Electrostatics & Its Applications; 1972, Wiley & Sons
11. Kravstov, P., et al.: Appl. Electr. Phenom. 2 (20): 147-154 (Mar.-Apr. 1968)
12. Popular Science (Oct. 1947), p. 94
13. Murr, L.E.: Advancing Frontiers of Plant Sciences 15: 97-120
14. Murr, L.E.: N.Y. Acad. Sci. Trans. 27 (7): 761-771 (1965)
15. Murr, L.E.: Nature 201: 1305 (1964); ibid., 203: 467-469 (1965); ibid., 208: 1305 (1964)
16. Sci. Amer. (19 Aug. 1911)
17. Kozhevnikova, N.F., & Stank, S.A.: Appl. Electr. Phenom. #2 (Mar.-Apr. 1966)
18. Headlee, T.: N.Y. Entomol. Soc. 37 (1): 59-64 (1929)
19. Headlee, T.: N.J. Experimental Station Bulletin #568 (April 1929)
20. Pittman, U.J.: Canadian J. Plant Sci. 43: 513-518 (1963); ibid., 52: 727-733 (Sept. 1972); ibid., 44: 283-287 (May 1964); ibid., 47: 389-393 (July 1967); ibid., 50: 350 (May 1970); ibid., 51: 64-65 (January 1971)
21. Strevoka, et al.: Planta 12: 327
22. Khevdelidze, M.A., et al.: Appl. Electr. Phenom. 1 (19): 52-59 (Jan.-Feb., 1968)
23. Chemical Abstracts 96: 49235b; ibid., 96: 67828b
24. Appl. Electr. Phenom. 6: 454-458 (Nov.-Dec. 1967)
25. Van Tassel, Geo.: Proc. College of Universal Wisdom; 1974, Big Rock, CA
26. Burridge, Gaston: Round Robin (Sept.-Oct. 1971), p. 17
27. Paleg, L.G.: Nature 228: 970-973 (1970)
28. Paleg, L.G., & Aspinall, D.: J. Gen. Physiol. 15: 391-420 (1932)
29. Dan Carlson Enterprises, Inc.: 708 - 119th Lane N.E., Blaine MN 55434 USA; Tel. 1-612-757-8274; Agro-Sonic Res. Farm: Tel. 1-715-425-1407; Fax 1-715-425-1727
30. Dycus, A.M., & Schultz, Alice: Plant Physiology Supplement #39
31. Shakhov, A.A., et al.: Biofizika 10, No. 4 (1965)
32 Shakhov, A.A.: Applied Electrical Phenomena 2: 134-145 (1965)
33. Biol. Abstr. 84: 83306

Top ~ **Home** ~ **Catalog** ~ **Links** ~ **Order**
rexresearch.com