Bulletin of Pure and Applied Sciences.
Vol.40 B (Botany), No.1.
January-June 2021: P.30-34
Review Article

Print version ISSN 0970 4612
Online version ISSN 2320 3196
DOI: 10.5958/2320-3196.2021.00006.9
Available online at www.bpasjournals.com

A Review on Electroculture, Magneticulture and Laserculture to Boost Plant Growth

[1]Victor Christianto*, [2]Florentin Smarandache

Author's Affiliation
[1]Malang Institute of Agriculture (IPM), Malang, Indonesia.
E-mail: victorchristianto@gmail.com.
[2]Dept. Mathematics and Sciences, University of New Mexico, Gallup – USA.
E--mail: smarand@unm.edu

***Corresponding author**:
Victor Christianto,
Malang Institute of Agriculture (IPM), Malang, Indonesia.
E-mail:
victorchristianto@gmail.com
Received on 02.02.2021
Accepted on 03.05.2021

***Keywords**:*
Electroculture, magneticculture, laserculture, plant growth, agriculture performance

Abstract
While several reviews on potential applications of electroculture are available, in this survey we discuss these issues from history, starting from earliest experiments by Ross. And in the last section, we discuss possible application of laserculture, another form of potential improvement. It is our hope that what we present here may be found useful for improving agricultural performance in many countries, as well as reducing dependence on fertilizer.

How to cite this article: Christianto, V., Smarandache, F. (2021). A Review on Electroculture, Magneticulture and Laserculture to Boost Plant Growth*Bulletin of Pure and Applied Sciences-Botany,* 40B (1), 30-34.

INTRODUCTION

To cause harvests to become bigger and quicker has been the essential worry of agribusiness for a long time. All strategies for development methods what's more, advances have been created to satisfy this point; from basic yield pivot to complex manufactured composts. Another development innovation found in farming is the use of power and attraction that can speed up development rates, increment yields, and improve crop quality. That innovation is called *electroculture*. Electroculture can shield plants from infections and creepy crawly and moreover diminish the prerequisites for manure or pesticides. Ranchers can develop greater and better harvests in less time, with less exertion (Barinov, 2012).

Harvest yields and quality are improved similarly. The energies are applied to the seeds, plants, soil or the water and supplements. Also, in this way huge loads of food can be developed in a quarter section of land or less, in gardens, on galleries, housetops, in window boxes or aqua-farming or permaculture. That converts into immeasurably expanded benefits for cannabis cultivators specifically, and some other culturist. Aqua-farming frameworks are obviously appropriate for electroculture (Nelson, 1982).

Also, there's more - a whole lot more, as the Russian scientists B.R. Lazarenko and I.B. Gorbatovoskaya detailed (with paraphrasing): "Reports that the attributes obtained by the plants in electrically treated soils are sent by legacy to the third era are especially fascinating. Affected by the electrical flow, the mathematical extents between hemp plants of various genders was changed by examination with the control to give an expanded number of female plants by 20-25%, regarding a decrease in the power of the oxidative cycles in the plant tissues." (Lazarenko & Gorbatovoskaya, 1966).

METHODOLOGY

In this article, we used methodology of literature survey. In this short literature survey, we discuss some methods which may have great impact in terms of plant growth and also reduce time needed to grow.

We tried to include not only literature from the Western publications, but also from Eastern Europe and also Asian authors, because some of the ideas are quite old.

HISTORY OF ELECTROCULTURE

Exploratory investigation of the impacts of power on plant development started in 1746, when Dr. Maimbray of Edinburg treated myrtle plants with the yield of an electrostatic generator, consequently upgrading their development and blooming. After two years, the French abbot Jean Nolet discovered that plants react with sped up paces of germination and in general development when developed under charged terminals(Nelson, 1982).

Starting in 1885, the Finnish researcher Selim Laemstrom tried different things with an airborne framework controlled by a Wimshurst generator and Leyden containers. He tracked down that the electrical release from wire focuses invigorated the development of yields like potatoes, carrots, and celery for an normal increment of about 40% (up to 70%) inside about two months. Nursery developed strawberry plants delivered ready natural product fifty-fifty the standard time. The yield of raspberries was expanded by 95%, what's more, the yield of carrots was expanded by 125%. Yields of cabbage, turnips, and flax, be that as it may, became preferred without jolt over with it. The Laemstrom framework included a flat radio wire suspended sufficiently high to allow furrowing, weeding and water system. The voltage applied to the reception apparatus differs from 2 to 70 KV, contingent upon the stature of the recieving wire. The current was around 11 amps.

In April 16, 1900, there was a **Nature** magazine edition, mentioned about electroculture:

ELECTRO-CULTURE.

THE results obtained by culture under the influence of electric light are fairly well known, and the growing of lettuce for salads, in spacious greenhouses with the aid of electric light, is already a profitable industrial pursuit in the United States (near Chicago and elsewhere). However, the use of electric currents for stimulating vegetation, although it was studied more than fifty years ago (by Ross, in 1844-46; continued by Forster, Sheppard, Fichtner, &c.), still remains unsettled. A communication upon this subject, made by a Russian engineer, V. A. Tyurin, before the St. Petersburg Electro-Technical Society, contains some welcome information upon the work done in this direction in Russia by M. Spyeshneff and M. Kravkoff. The former experimented a few years ago on three different lines. Repeating well-known experiments on electrified seeds, he ascertained once more that such seeds germinated more rapidly, and gave better fruit and better crops (from two and a half to six times higher), than seeds that had not been submitted to preliminary electrification. Repeating next the experiments of Ross—that is, burying in the soil one copper and one zinc plate, placed vertically and connected by a wire, he found that potatoes and roots grown in the electrified space gave crops three times heavier than those which were grown close by on a test plot; the carrots attained a quite unusual size, of from ten to twelve inches in diameter. Spyeshneff's third series of experiments was more original. He planted on his experimental plot, about ten yards apart, wooden posts provided at their tops with metallic cigarettes connected together by wires, so as to cultivate his plants under a sort of network of wires. He obtained some striking results, one of which was that the growth and the ripening of barley were accelerated by twelve days. Quite recently M. Kravkoff undertook a series of laboratory experiments upon beans of soil submitted to electric currents. The temperature of the soil was raised by these currents; its moisture decreased first, but began to increase after a course of three weeks (the same increase of moisture was also noticed by Fichtner); and finally, the amount of vegetable matter in the soil was increased by the electric currents. With what is now known upon the influence of micro-organisms upon vegetation, further research on similar lines is most desirable and very promising.

Maryland Geological Survey.

Under the vigorous direction of the State Geologist, Prof. W. Bullock Clark, the Maryland Geological Survey has just issued its third volume; one of a series which in type and illustration is one of the most excellent of all the geological reports published in the United States. The present volume deals wholly with questions of economic geology treated from a scientific as well as a practical point of view. It is, in fact, a manual on road-materials and road-construction. The dependence of the highways upon the surface configuration of the land, and the bearing of the distribution of temperature and rainfall are pointed out. Attention is rightly paid to the relationship between the stony structure of the ground and the roads. The questions of construction and repair, and the qualities of road-metals are dealt with in detail, and the construction of macadam roads is described. Various administrative matters are also dealt with. Illustrations are given of the method of road-making since early times; there are numerous photographic illustrations of types of roads formed of different materials, including types of best roads in Maryland;

Figure 1: Coverage on electroculture in *Nature,* 1900.

Another old book on electroculture was published by EC. Dudgeon:

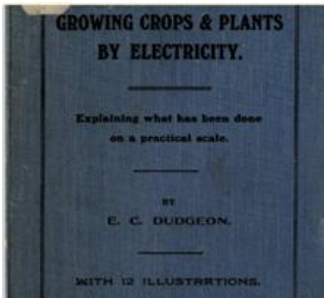
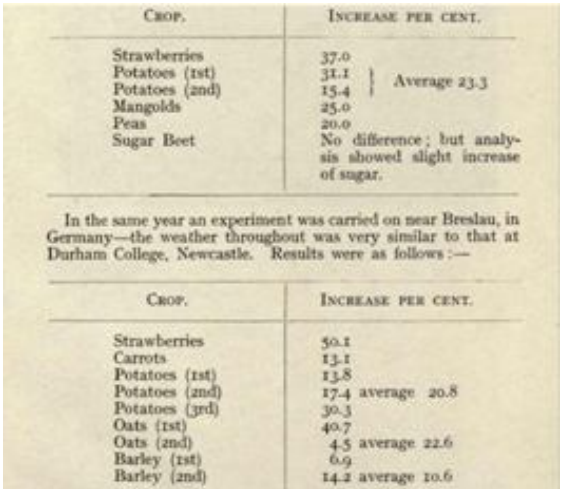


Figure 2: EC Dudgeon's book (unknown date)

Among other things, Dudgeon reported experiments by Prof. Laemstrom:



Crop.	Increase per cent.
Strawberries	37.0
Potatoes (1st)	31.1
Potatoes (2nd)	15.4
Mangolds	25.0
Peas	20.0
Sugar Beet	No difference; but analysis showed slight increase of sugar.

Average 23.3

In the same year an experiment was carried on near Breslau, in Germany—the weather throughout was very similar to that at Durham College, Newcastle. Results were as follows:—

Crop.	Increase per cent.
Strawberries	50.1
Carrots	13.1
Potatoes (1st)	13.8
Potatoes (2nd)	17.4 average 20.8
Potatoes (3rd)	30.3
Oats (1st)	40.7
Oats (2nd)	4.5 average 22.6
Barley (1st)	6.9
Barley (2nd)	14.2 average 10.6

Figure 3: Crop growth improvement, EC Dudgeon (unknown date)

In 1909, the Swiss minister J.J. Gasner acquired comparable outcomes with his replication of Laemstrom's work. Likewise that year, Prof. G. Stone showed that a couple of sparkles of friction based electricity released into the dirt every day expanded soil microbes up to 600%.

During the 1920s, V.H. Blackman revealed his examinations with an aeronautical framework like that of Laemstrom. He applied 60 volts DC/1 milliamp through 3 steel wires each 32 ft long and suspended 6 ft separated and 7 ft high on posts. The course of action expanded yields about half for a few plant types (Nelson, 1982).

Wet soil improves current stream. Electrocultured plants need about 10% more water than control plants in light of the fact that the charged water is sweated more quickly than under typical conditions.

ANTENNA SYSTEMS

As discussed by Barinov, it is also possible to implement antenna systems to improve plant performance. The French rancher Justin Christofloreau stood out in 1925 with his contraption to gather barometrical energy for his yields. Clover treated by his strategy grew 7 feet high. Christofloreau's contraption comprised of a 25-ft wooden post; at the top was a metal pointer adjusted north-south, and a reception apparatus. Copper and zinc strips were bound together to produce power from sun based warmth. A few of the shafts were set around 10 ft separated, and the wires driving from them reached out about 1000 yards. Christofloreau asserted that the amassed power obliterated parasites and advanced advantageous synthetic cycles in the dirt (Barinov, 2012).

In 1924, Georges Lakhovsky contrived his Oscillator Circuit, a one-become copper curl with covering closes isolated by a hole. Capacitance creates swaying flows that advantage the plants. The ring is upheld by an encasing like a plastic bar. This amazingly straightforward course of action animates plant development.

Other setups likewise upgrade plant development. A funnel shaped loop of solid wire twisted with 9 turns (counter-clockwise in the Northern Hemisphere, clockwise in the Southern), when stuck in the ground around 1 ft north of a plant, will gather barometrical power. Associate a wire from the fence to a metal bar close to the plants. A television reception apparatus likewise can be utilized. Rebar can be sunk into the ground at each end of a column of plants, associated by an uncovered wire under the dirt or potentially noticeable all around. A north-south direction will exploit geomagnetic extremity (Butchbaker, 1976).

More Recent Development: Solar Powered Electroculture

As discussed by E.M. Reyes et al., supporting the idea of power's part in plant development incitement and utilization of sun oriented innovation, the scientist planned and built up a venture that would help increment the development of plants without losing their quality and nourishment. Electroculture with appropriate watering framework will assist the plants with developing. Besides, the convenient sun based force supply might be utilized to control up the undertaking for a more financially savvy activity (Reyes *et al*, 2019).

Moreover, they concluded as follows (with paraphrasing):
"An all around planned electroculture strategy significantly affects family pay. As seen in the investigation, the ordinary gathering season of pechay plants is diminished by seven days. This implies decrease in the utilization of water, composts and bugs controls. Also, electroculture procedure outlines low support and working expense that best fits for each ranchers developing vegetables plants. It will give ranchers an opportunity to develop great yields quicker, lessen ecological issues brought about by utilizing natural composts what's more, increment their pay." (Reyes *et al.*, 2019).

MAGNETICULTURE

"Magneticulture", as the name suggests, utilizes attractive fields from mineral magnetite (Fe_3O_4), lasting magnets, or electromagnets to influence plant digestion. Spread magnetite in a ring around the roots, or in a north-south line. The indistinct attractive field will improve the germination and resulting advancement to different degrees relying upon the plant, developing conditions, and the sort, extremity, and strength of the attractive field (Nelson, 1982).

Agronomist Yannick van Doorne has built up a "*attractive radio wire*", a chamber loaded up with beeswax and magnets, wrapped with a curl, and electrostatically charged. The gadgets are set at the finishes of lines furrowed north and south, and associated with electrifies steel wire.

The resultant yields are nutritious, and heavenly, and three to multiple times greater than expected since the most recent ten years in similar fields."

The technique created by Pearl Eitan (Patent IL31428) requires the utilization of 100 lb of magnetite / section of land with an electrostatic charge. The outcome is "*resistivity to subfreezing temperatures and creepy crawlies, expanded organic product size, yield, development rates, and expanded number of crops/year*." (Nelson, 1982).

Laserculture: Effects of UV-B radiation, Laser irradiation, and LED lighting

Apart of the aforementioned methods to improve plant growth, there are other methods based on ultraviolet (UV-B) and laser / LED irradiation. We will discuss these possible treatments one by one.

As reported by Zuk-Golaszewska et al:
"In the investigation directed in the nursery, the various portions of UV-B radiation applied to the two species initiated changes in leaf and plant morphology. It was an abatement of plant tallness, new mass of leaves, shoots and roots just as leaf region. Additionally, itcaused the leaf twisting in both of the species. The huge contrasts between the two are in the considered attributes werebasically because of the tillering capacity of the species. The substance of chlorophyll shifted impressively. The normal estimations of leaf greenness (SPAD units) for oats were around 43 while for green foxtail 32, separately. U-VB didn't diminish leaf weight proportion, shoot dry matter, shoot to root proportion and leaf territory proportion."(Zuk-Golazewska et al., 2003)

Moreover, with regards to laser applications in agriculture, M. Hasan wrote that laser innovation can be a helpful choice to be joined into frameworks of rural creation. Accordingly, more consideration was given as of late to actual elements that might be appropriate to preparing of planting material. To guarantee a high seed execution, different techniques for handling are utilized, including substance arrangements, for example, seed immunization by synthetic material and development controllers, just as actual components, including laser light and attractive fields. Pre-planting treatment was

applied to invigorate the seeds to all the more likely sprout and fill quicker in different planting conditions. The utilization of actual elements for controlling the impact of organic conduct during advancement and capacity of various societies is a cutting edge pattern in joining the strengthening of plant innovations with environmental necessities (Hasan *et al*., 2020).

The mechanism of LASER improvement of plant growth is outlined as follows: The premise of the incitement component in any plant physiological stage is the synergism between the enraptured monochromatic laser bar and the photoreceptors that, when set off, initiate various organic responses. There are numerous realities that demonstrate the biostimulating activity of laser radiation on different organs and tissues in creatures and plants. The plants assimilate light through their photoreceptors (Hernandez *et al*., 2010).

And last but not least, there is also PARUS technology, which uses LED lighting to improve plant growth processes.[1]

All of these seem to suggest that laser / UV-B radiation along with LED lighting are very promising alternatives too in order to boost plant growth.

CONCLUDING REMARK

In this short literature survey, we discuss some methods which may have great impact in terms of plant growth and also reduce time needed to grow. Those methods include electroculture, antenna systems and also magneticculture.

Apart of the aforementioned methods to improve plant growth, there are other methods based on ultraviolet (UV-B) and laser / LED irradiation. We discuss these possible treatments one by one.

Version 1.0: 31 march 2021, pk. 1:52
Version 1.1: 07 April 2021, pk. 20:12
Version 1.2: 20 April 2021, pk. 15:03
VC & FS

[1] Parus technology. Plants grow with LED Lighting. http://www.parus.co.kr

REFERENCES

1. Barinov, A. 2012. The effect of electricity on plant growth. No. 1535, Moscow (in English). http://liceum1535.ru/about/conference/papers/1_Barinov_1535.pdf
2. Butchbaker, A.F. 1976. *Electricity and Electronics for Agriculture*.
3. Dudgeon, EC. Growing crops and plants by electricity. London: S. Rentell & Co.
4. Hasan, M. 2020. et al. Laser Irradiation Effects at Different Wavelengths on Phenology and Yield Components of Pretreated Maize Seed. *Appl. Sci*. 10, 1189. doi:10.3390/app10031189
5. Hernandez, A.C. et al. 2010. Laser in agriculture. *Int. Agrophys.*, 2010, 24, 407-422.
6. Lakhovsky, G. 2010. *The Secret of Life.*
7. Lazarenko, B.R. & Gorbatovoskaya, I.B. 1966. *J. Applied Electrical Wonders* #6, March-April.
8. Nelson, R.A. 1982. *The Next Big Thing: ElectroCulture.*
9. Reyes, A.M., Jordan, G., Achico, M.. 2019. Solar-Powered Electroculture TechniqueFor Backyard Farming. *International Journal of Advanced Research and Publications*, vol. 3(3).
10. K. Zuk-Golaszewska et al. 2003. The effect of UV-B radiation on plant growth and development. *Plant Soil Environ.*, 49(3): 135–140.