Harnessing the Potential of Electroculture in Field Crops

Prajojita Rout*

M.Sc. Scholar, Department of Agronomy, College of Agriculture, OUAT, Bhubaneswar, Odisha, India - 751003

Corresponding Author
Prajojita Rout
Email: prajojitarout511@gmail.com

OPEN ACCESS

Keywords

Electric current, Electroculture, Growth, Soil Fertility, Telluric current.

How to cite this article:

Rout, P. 2025. Harnessing the Potential of Electroculture in Field Crops. *Vigyan Varta* 6(7): 82-85.

ABSTRACT

An old but increasingly popular agricultural technique is electroculture, which uses a variety of electrical or electromagnetic phenomena to affect crop yields and plant growth. This page offers a thorough introduction to electroculture, exploring its basic workings, wide range of uses, and benefits and drawbacks. The procedures include techniques for directing soil electrification to improve the physical, chemical, and biological qualities of soil by employing air electricity captured by antennas. Grain, vegetable, and fruit crops have all benefited from electroculture in the past and present (Briggs, 1926). Advocates point to increased biomass, faster germination, higher yields, better crop quality, and increased resistance to pests and diseases, which frequently suggests a decreased need for artificial fertilizers and pesticides (Christianto & Smarandache, 2021). The goal of this analysis is to incorporate current knowledge while emphasizing areas that call for a fair assessment of electroculture's potential as a sustainable agricultural technique.

INTRODUCTION

Electroculture involves applying low-voltage electric currents to soil, which can enhance nutrient uptake and stimulate plant growth. Some countries where Electroculture research and application have been conducted are France, Japan and USA.

Production of current

In the context of producing an electric current several methods can be employed, including the use of simple galvanic cells or AC current and antennas that captures atmospheric electricity.

APPLICATION OF CURRENT IN THE FIELD

1) **Galvanic cell:** A galvanic cell can be created by using two different metals inserted into the soil at a distance among them and a wire is connected to complete the circuit.

➢ **Mechanism:** Soil behaves like electrolyte. The electric potential difference makes the electron flow from anode to cathode which produce current (Abasi *et al.,* 2020).

2) **Atmospheric antenna:** Antennas can capture ambient electric charges from the air particularly in areas with high natural electrostatic activities. From the very bottom of the stake (about a foot underground), we must wind the copper wire in a clockwise or counterclockwise direction before expanding it at the antenna's top.

➢ **Mechanism:** The antenna captures telluric currents also known as earth currents, are natural currents that flow underground or through large bodies of water. These currents are induced by various natural phenomena, such as geomagnetic activities, variations in the earth's magnetic field, often caused by solar activity like solar flares and geomagnetic storms (Helman, 2014).

3) **Thermoelectric generation:** Utilizing the temperature differential between the atmosphere and various soil components. It is necessary to use thermoelectric materials, such as copper and constantan thermocouples. To guarantee that there is a temperature differential between the two junctions, one thermocouple junction is positioned in the earth and the other in the air.

➢ **Mechanism**: A voltage differential between the two junctions is produced by the temperature differential. This could lead to the generation of an electric current.

HOW ELECTRIC CURRENT ENHANCES SOIL FERTILITY?

Here are the primary ways in which electric current enhances soil fertility.

1/ **Enhanced microbial activity:** Stimulation of beneficial microbes. Low-voltage electric currents can stimulate the activity of beneficial soil microorganisms, such as bacteria and fungi (Kambouris, 2023). These microbes play a crucial role in decomposing organic matter, fixing N and making nutrients available to plants.

It drives oxidation and reduction of soil compounds.

2/ **Improved nutrients uptake:** Ion movement: Electric currents can facilitate the movement of nutrients ions (such as nitrate, phosphate and potassium) towards the plant roots through a process called electro-osmosis.
This increases the amount of vital nutrients that plants can access (Ellis & Turner, 1978).

3/ **Soil structure and water retention:** Soil aggregation: Electric currents can promote the formation of soil aggregates, which improve soil structure. Better structure enhances water infiltration, retention and root penetration.

4/ **Reduction of soil compaction:** Electric current can be used to reduce soil compaction, making it easier for roots to grow and access nutrients.

5/ **pH regulation:** Electrochemical reaction: By generating hydrogen ions, which acidify the soil, or hydroxide ions, which alkalize the soil, electric currents can initiate reactions that change the pH of soil. Plants may have greater access to nutrients if the pH of the soil is changed.

6/ **Detoxification of harmful substances:** Electric current can help break down harmful contaminants in the soil, such as heavy metals and organic pollutants, through processes like electro kinetic remediation (Probstein & Hicks, 1993).

APPLICATION IN FIELD CROPS

The potential applications of electroculture in large – scale field crops are vast and diverse. For instance:

- **Cereal crops (Wheat, Rice, Maize):** Studies have shown increased tillering, grain yield and nutrient content in cereal crops subjected to electroculture (Hussain *et al.*, 2020). This could be particularly impactful in regions striving for food security.

- **Legumes (Soybean, Chickpea):** Enhanced nodulation & N-fixation in legumes due to electroculture could reduce the reliance on synthetic N-fertilizers, promoting sustainable agricultural practices (Lu *et al.*, 2020).

Benefits of electroculture

- Enhanced growth
- Disease resistance
- Soil fertility
- Water savings
- Reduced input costs

Drawbacks

- Upfront costs like investment on generators, electrodes and monitoring system can be barrier.

- It requires a certain level of technical expertise.

- Improper disposal of electrodes could contribute soil and water pollution.

CONCLUSION

Harnessing the power of electroculture in field crops presents an exciting frontier in sustainable agriculture. While more research is undoubtedly needed to fully unravel it's complexities and optimize its application, the accumulating evidence points towards a transformative technology capable of boosting yields, reducing chemical inputs, & enhancing crop resilience. As we navigate the challenges of feeding a growing global population in an environmentally responsible manner, embracing innovative approaches like electroculture may well be a vital step towards a more productive, sustainable and resilient agricultural future.

REFERENCES

Abasi, S., Aggas, J.R., Venkatesh, N., Vallavanatt, J.G., & Guiseppi-Elie, A. (2020). Design, fabrication and testing of an electrical cell stimulation & recording apparatus (ECSARA) for cells in electroculture. *Biosensors and Bio electronics 147,111793*

Briggs, L.J. (1926). Electroculture. (U.S. Department of Agriculture Department bulletin No. 1379). *U. S. Department of Agriculture*

Christianto, V., & Smarandache, F. (2021). A Review on Electroculture, Magneticulture & Laser culture to Boost plant growth. Bulletin of Pure & Applied Sciences -Botany, 40(1).

Ellis, H.W., & Turner, E. R. (1978). The effect of electricity on plant growth. *Science Progress (Oxford), 65, 395-407.*

Helman, D.S. (2014). Earth electricity: A review of mechanisms which cause telluric currents in the lithosphere. *Annals of Geophysics, 56(5), G0564.*

Hussain, M.S., Dastgeer, G.,Afzal, A.M., Hussain,S., & Kanwar.R.R. (2020). Eco-friendly magnetic field treatment to enhance wheat yield and seed germination growth. *Environmental Nanotechnology, Monitoring & Management,14,100299.*

Kambouris, M.E. (2023). Harnessing fields, waves and currents: The Realm of Mages. *Biosecurity in the making, 133-149.*

Lu, S., Guan, X., & Liu, C. (2020). Electricity – powered artificial root nodule. *Nature Communications, 11(1), 1505*

Probstein, R.F., & Hicks, R.E. (1993). Removal of contaminants from soils by electric fields. *Science,260(5107), 498-503.*