The Theories and Effects of Imposing Natural Electrical Fields and Currents on Potted Plants

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Background

The natural environment on Earth is infused with sound frequencies, electrical currents, and geomagnetic forces that plants and all organisms have adapted to and utilized for millions of years of evolution (1 - 4). Due to the Earth's immense electrical conductivity and topographic variations, the Earth's surface can rapidly adjust to changes in electrical potential (2,4). Variations of electrical potential at different locations on the Earth's surface result in electrical currents called telluric currents (2,5). All known organisms have evolved with the Earth's global electrical circuit field and have been connected to Earth's telluric currents and ionic charge throughout their existence. It is theorized that plants have adapted characteristics to sense changes in the atmospheric ionic balance in the air and the Earth's electrical conductance in order to prepare for influxes of rain or soil nutrients (6). Researchers have shown plants can utilize artificial electromagnetic fields as a guide for growth and development (7). Scientists have also observed plants being dramatically influenced by electro-tropism (a kind of Tropism which results in growth or migration of an organism, usually a cell, in response to an exogenous electric field) from local electrical bodies or electrical fields/currents (8,9).

Plants grown in insulated pots in artificial indoor environments are exposed to a variety of factors that can induce stress and compromise growth, development, and reproduction (10). Due to plants sessile nature and ancient survival adaptations, stresses can trigger a wide range of cellular responses from altered gene expression and cellular metabolism to changes in growth rates and crop yields (11,12). It is theorized that when plants have been disconnected from the electrical nature of the Earth and placed into pots, they are instantly being put into a stressful environment.

This experiment researches the effects of electrically reconnecting insulated potted plants to the Earth through a grounding cord. In electronic circuit theory, the Earth or "ground" is idealized as an infinite source or sink for charge, which can absorb an unlimited amount of current without changing its potential (14). I have theorized that by reconnecting a potted plant to the electrical nature of the Earth, the plant's cells and chemical reactions are able to more efficiently maintain a homeostasis "metabolic balance." This theory is based on research into the electrophysiology of plants, studies on the influence of electrical fields and currents on plants, and grounding's known influx of Direct Current (DC) from the Earth and simultaneous mitigation of extraneous Alternating Current (AC) (7 - 9,13). As a result of a grounded plant becoming "stress free" and "increasing cellular metabolic efficiency," I believe I will observe an increase in growth and production rates of my grounded Jalapeno pepper plants since they will theoretically be able to better handle adverse variations in temperature and environmental conditions within the greenhouse as compared to the non-grounded control pepper plants.

Methods and Materials

This experimentation on grounded pepper plants was conducted during the summer of 2012 at the Brown University Greenhouse Environmental Facilities under the supervision of Fred Jackson, Director of the Plant Environmental Center and Stephen Doyle, Co-founder of Earth & Grow grounding systems. The summer experiment consisted of twenty Jalapeno pepper plants, which were a few week old seedlings. Jalapeno peppers were chosen as the desired experimental plant because they are one of the most commercially viable plants in the world and their ease of growth would allow us to determine how grounding affects plant production and yield.

The experiment was arranged so that all of the control plants were positioned on one galvanized rolling bench while all of the grounded plants were situated on a different separated bench to prevent any residual grounding effects on the control plants. Two insulated plastic trays were set up on the two adjacent growing benches in a private section of a 900 square foot Lord & Burnham glass greenhouse to ensure non-biased experimentation and to discourage public influence. Both experimental groups were consistently rearranged to different areas of the greenhouse in order to limit location biases. All the plants were potted in two gallon black plastic pots with Fafard #2 soil.

On one bench, ten identical seedlings were grounded and plugged in with Earth & Grow devices that were inserted into the plants' growing medium at an angle towards the center of the pot. On an adjacent bench, ten identical pepper plants were not grounded and used as controls.

All numbered plant pairs were identical in height and age at the start of the experiment. All the plants were fed equal portions of water daily and were fertilized once with slow release Osmocote. Growth and electrical measurements were recorded once a week. Growth fluctuations were measured using a ruler and a tape measure.

Electrical characteristics were measured using an electrician's multi-meter. To take measurements using the multi-meter, the black negative measuring probe is inserted into a local ground port to use as a neutral comparison and the red positive measuring probe is inserted into the plants growing medium positioned at an angle towards the center of the pot. Electrical measurements consisted of recording the electrical DC intake on all grounded pepper plants that were plugged in with Earth and Grow grounding system. Comparative photographs and observational notes were also taken weekly to document all the visual changes throughout the duration of the experiment.

Crop production ratios between grounded and control plants were measured, as well as production weight comparisons. The growth, electrical, and yield fluctuation graphs provide insight into the Earth's electrical influence on plant life.

Objectives

The objective of this experiment is to advance the knowledge of electro-tropism and the influence of natural earth currents on plant life. Throughout this experiment involving twenty Jalapeno plants I aim to determine if electrical grounding has an observable influence on the growth and yield production. By investigating the influence of electrical grounding on plant growth, this research has the opportunity to promote an alternative way to increase indoor agriculture production and discover a new understanding of how the Earth's electrical nature affects the physiology of plants. Tapping into the electrical physiology of plants and the charges of the Earth has the potential to show us crucial information on how plants' electrically respond at different stages of growth, how they receive and transmit complex environmental information, and how they stimulate chemical compounds and reproductive production under the influence of natural electrical currents and frequencies.

My theories on grounding's influence on plants are supported by the experiment discussed in this presentation along with the experiments conducted and studies accumulated by Andrew Goldsworthy. Goldsworthy's experiments and studies concluded that time-varying electromagnetic fields and currents imposed on plant life will induce eddy currents in and around living cells that remove some calcium ions that help to stabilize their membranes. He proposed that these displaced calcium ions are replaced by smaller, lighter ions like potassium that are less efficient at stabilizing membranes. As a result of these changes in ionic charge, there is an increase in transient pores formation that simultaneously increases membrane permeability and influences metabolism (6).

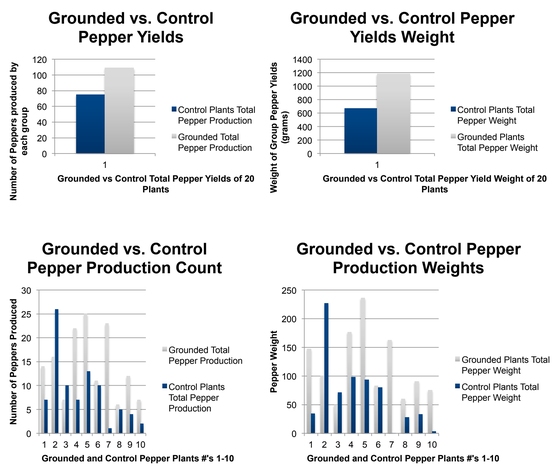
Overall Observational Results

Control vs. Grounded Pepper Groups of Ten (3 Months Old)

Control Peppers — Grounded Peppers

Grounded vs. Control Pair Production Comparison (In Each Flat Grounded on the left, Control on Right)

Jalapeno Pepper Production Results



Results

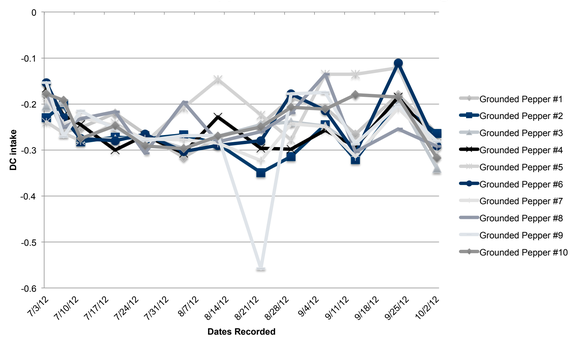
Throughout this experiment there were many significant observations recorded. Eight out of the ten grounded pepper plants were observed and recorded to grow larger and faster than the control plants. However, not only did the grounded plants increase their height faster than the control plants, but they also had dramatic increases in undergrowth, node development, branching, leaf health (size, structure, heat resistance, and color vibrancy), flowering, electrical variations, pepper yield and overall health and vigor. Some of the grounded plants were smaller than their control pairs for the first few weeks but by the end of the first month of experimentation, the grounded peppers were equal or larger in height than the control plants (see "Overall Growth Results" graph) Most of the grounded plants flowered earlier and had more buds than the controls.

After analyzing the electrical, growth, and observational data recorded throughout the experiment, there were interesting correlations. All of the grounded pepper plants' DC electrical trends were very similar. Also the DC electrical variation recordings matched all of the grounded plants' growth, flowering, and pepper production trends almost identically. At the same time, when all the grounded plant species began dramatically increasing growth development, their electrical DC intake started increasing and then decreasing dramatically during the first month of experimentation (8/1 - 8/5). During the second month of experimentation almost all of the grounded plants started drastically decreasing current after a steady increase which correlated almost perfectly with the development of mature peppers (9/3 – 9/10). Also all of the grounded plants successfully mitigated any extraneous AC in the surrounding environment by remaining at "0" potential and discharging static into the ground line throughout the entire experiment.

The most intriguing data collected was the pepper production results. There was a recorded 70% increase in the number of grounded peppers produced compared with the production of the ten pepper controls. However not only was there a 70% increase in production count but there was a 145% increase in the grounded peppers' weight yield compared to the control (see "Production Results" graph). After analyzing the growth measurements and finding the average heights of both the control and grounded plants, there was a conclusive 16% increase in grounded pepper growth as compared to control growth. Comparing each individual pair of grounded and control plants, the grounded plants increased growth ranging up to 36%. The electrical and growth data collected throughout this experiment provides a rare insight into plants' electrical regulation of their flowering, development and fruit production.

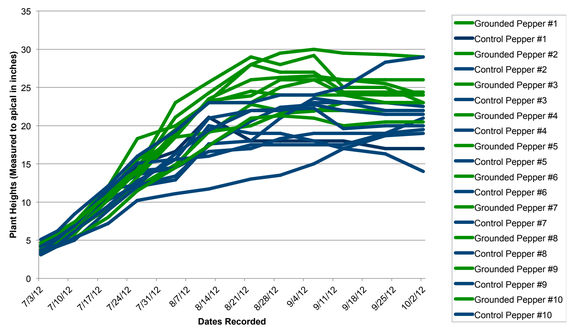
Overall Electrical Results

Grounded Peppers Electrical DC Recordings



Overall Growth Results

Grounded vs. Control Height Growth Over 3 Months



Conclusion

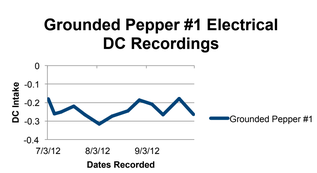
Grounding insulated potted plants has shown positive and dramatic results. The ten Jalapeno pepper plants that were grounded have all shown significant reactions from being connected to Earth's electrical energy with the Earth & Grow grounding devices. Over the duration of the experiment the majority of grounded Jalapenos were observed to grow bigger and faster than the control plants as seen in the graphs provided.

This experiment provided insight into the electrical fluctuations of grounded potted plants and how their growth, flowering, and fruit production could be related to specific fluctuations of Direct Current. This experiment also showed how grounded plants can completely mitigate AC fields from their surrounding environment. Exposure to AC fields are theorized to stress and stunt the control plants' metabolic functions and growth patterns. The data from this experiment supports my theories that electrically grounding plants increases their growth, health, and production.

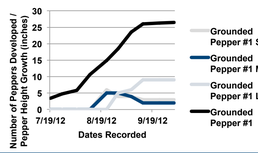
Control vs. Grounded Pepper Plants #1 (3 month duration) – G on Right, C on Left

Grounded #1 Jalapenos on Left vs. Control #1 on Right

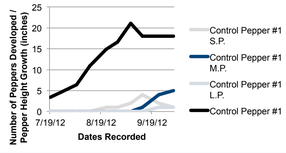
Grounded Pepper #1 Electrical DC Recordings



Grounded Pepper #1 Yield Development/Growth



Control Pepper #1 Yield Development/Growth



References

1. Ober, Clinton. 'Earthing: The Most Important Health Discovery Ever?' *Basic Health Publications, Inc.*, 2010.
2. Chavalier, Gaetan. 'The Earth's Electrical Surface Potential: A summary of present understanding.' January 2007.http://www.earthinginstitute.net/ commentaries/gaetan_electrical_surface.pdf
3. Murr, L.E. 'Physiological stimulation of plants using delayed and regulated electric field environments.' *International Journal of Biometeorology,* 1966, Volume 10, Number 2. http://www.springerlink.com/content/h1h801422u7740w1/?MUD=MP
4. Anion Family Inc. 'What are Negative Ions?' http://www.anionfamily.com/ ion_what.htm
5. 'Telluric current.' *Encyclopedia Britannica. Encyclopedia Britannica Online*. Encyclopedia Britannica, 2011. Web. 31 Jan. 2011. http:// www.britannica.com/EBchecked/topic/586372/telluric-current
6. Goldsworthy, A. (2006), 'Effects of Electrical and Electromagnetic Fields on Plants and Related Topics', in Volkov, A. G. (eds.), Plant Electrophysiology: Theory and Methods, Berlin: *Springer*
7. Gorgolewski, S; Rozej, B. 'New evidence for electrotropism in some plant species.' 34th COSPAR Scientific Assembly, The Second World Space Congress, held 10-19 October, 2002 in Houston, TX, USA., meeting abstract. http://adsabs.harvard.edu/abs/ 2002cosp...34E2404G
8. Pozdnyakov, Anatoly. 'Electro-tropism in "Soil-Plant" System.' Moscow State Univ, Soil Science Dept. 15, July 2006, 116-29. http://crops.confex.com/crops/wc2006/ techprogram/P17296.HTM
9. Lazarenko, B. & Gorbatovskaya, J. *Applied Electrical Phenomena* #6 (March-April 1966).
10. Syed, Ibrahim. 'Beneficial Effects of Lightning' Islamic Research Foundation International, Inc. http://www.irfi.org/articles/articles_51_100/ beneficial_effects_of_lightning.htm
11. Shepherd, VA. 'From semi-conductors to the rhythms of sensitive plants: the research of J.C. Bose.' *Cell Mol Biol (Noisy-le-grand)*. 2005 Dec. http://www.ncbi.nlm.nih.gov/ pubmed/16359611
12. Graham & Wilcox. Plant Physiology: *Plant Biology* (Second edition) – Chapter 12: Plant Behavior - 12.1 Plants sense and respond to external and internal signals.
13. L.E. Murr. 'Plant Growth Response in a Simulated Electric Field-environment.' *Nature* (02 November 1963).
14. 'Ground (electricity).' http://en.wikipedia.org/wiki/Ground_(electricity)

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