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Study On The Electrophysiological Assessment Of The Effects Of Different Voltages Of Electric Current On The Growth And Morphology Of Brown Chickpea (*Cicer Arietinum*).

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ABSTRACT

Electro culture is a horticultural technique that utilizes electricity used to create a magnetic field that supports plant growth. The fundamental elements in electro culture are voltage output, conductor, and plant. The researcher prepared 4 setups with 20 brown chickpea plants, each using 5 Volts, 9 Volts, and 12 Volts. For three weeks, in the experimental groups current was induced in different voltage output for one hour in every 24 hours a day while the controlled group does not receive any treatment. Out of all given treatments, the plants from the 12 volts group showed the best results in stimulating the growth parameters of the Brown chickpea plant. Results indicated a significant difference in the growth of the chickpea plants in terms of plant height and mass. However, there is significant difference in terms of the colour and number of leaves of the experimental plant group.

Keywords: *Brown chick pea plant, Electro culture, Horticultural techniques, Plant Growth, Voltage output.*

INTRODUCTION

According to Manguiam et al. (2019), the world's rising population needs a higher supply of food. The need for food will become increasingly urgent with the rapidly rising population. According to Achico and Reyes (2019), Experts say farmers now lack the ability to grow edible plants of good quality. In the Jharkhand, there is a surging number of gardeners that developed their talents in planting. One of the horticulture techniques that can help the plant grow faster is an electro culture .. Electro culture is a horticultural technique that uses electricity to help the growth of a plant. Since renewable energy is abundant today, it is easy to produce electricity anywhere to use for electro culture. To conduct the horticultural technique of electro culture, a conductor is used .

The conductor acts as a passageway for electricity to flow. In this experiment, there are different voltages that we use 5 Volts, 9 Volts, and 12 Volts. This part of the study outlines the problems that are wanted to be addressed at the end of the study. (1) Determine if there is a difference between experimental groups based on the following dependent variables. (2) Determine if there is a significant difference by comparing the experimental group to the controlled group using dependent variables. (3) Assuming that there is a stimulating effect, describe the most effective method of applying voltage using electro culture. In this research, we will use a Black chickpea plant, and the voltage that we are going to apply to the treatment is 5 Volts, 9Volts, and 12Volts. During the experimentation period, mass, height, the colour of the leaves, and the number of leaves are measured.

MATERIALS & METHODS

The seeds of *Cicer arietinum* (Brown Chickpea) were collected from local shop. A total of 24 seeds were used in this experiment, ensuring uniformity in size and quality.

Four pots were labeled as Control, 5V (A), 9V (B), and 12V (C), each filled with garden soil rich in humus. The pots were 6 inches in height. A DC power voltage supplier, capable of settings at 5V, 9V, and 12V, was utilized. Stainless copper electrodes connected to the DC voltage supplier were inserted into the soil in the pots.

The chickpea seeds were soaked in water for 12 hours prior to planting. The soil in the pots was prepared to be fertile and suitable for planting. The seeds were sown at a depth of 2-3 inches in the soil, with each pot containing 5-6 seeds. The pots were placed under controlled conditions with adequate exposure to sunlight and were gently watered on a scheduled basis until sprouts emerged from the soil.

On the fifth day after sowing, an electric field was applied. Pots A, B, and C were connected to 5V, 9V, and 12V, respectively, using stainless copper electrodes placed at both ends of the pots.

Data Analysis

Data were analyzed using statistical software R and SPSS,. Descriptive statistics were calculated to summarize the data, including means and standard deviations for each treatment group. ANOVA (Analysis of Variance) was conducted to determine statistically significant differences between the means of the different voltage treatments, with a significance level set at $p < 0.05$. The significant differences were found, Tukey's HSD (Honest Significant Difference) test was applied for post-hoc analysis.

Graphs were generated using MS Excel Line graphs illustrated growth trends over time, while bar charts compared growth parameters across the different voltage treatments.

RESULTS & DISCUSSIONS

The results from the data that are gathered implicate that electro culture has an impact on the plant development of tomato plants. By observing the different voltages, researchers noticed a significant difference between the controlled and experimental groups in terms of mass, height, and colour of leaves. Nevertheless, when it comes to the number of leaves, there is no significant difference between the controlled group and experimental groups.

Based on the data from the researcher's experiment on a 5 Volts set-up, the weight and height show that there is a significant difference, while the colour of leaves and number of leaves show that there is no significant difference. The 9 volts have significant differences in weight, height, and colour of leaves, and there is no significant difference in the number of leaves. Lastly, there is a significant difference in weight, height, and colour of leaves and no significant difference in the number of leaves in the 12 volts. Therefore, by observing the different voltages, there is an effect on the leaves' height, weight, and colour on a specific voltage output on the brown chick pea plant (*Cicer arietinum*). For the second statement of the problem, the data were compared using the t-Test as the statistical treatment to identify a significant difference between the experimental and control groups. With the data in the control group vs. the 5 Volts set-up, there is a significant difference in height and weight, while in the control group and the 9 Volts set-up; there is a significant difference in terms of height, weight, and colour of the leaves. Furthermore, in the control group and the 12 Volts set-up, there is a significant difference in height, weight, and colour of the leaves. And for the third statement of the problem, according to the researchers' experiment, the most effective electric current is 12 Volts set-up because it has the highest weight, the longest height, and the greatest number of leaves in a short period. Except for the colour of leaves, 5 Volts set-up is the most effective when it comes to leaf colour using the Leaf Colour Chart (LCC). Based on the observations made during the experiment, 9 volts produces the most significant plant growth outcomes and effectiveness. This research focuses on electro culture, a horticultural method that uses electricity to enhance plant growth development, and the researchers' purpose is to find the essential and most effective volts (5 V, 9 V, 12 V) in brown chickpea plants (*Cicer arietinum*) by comparing the controlled group and experimental groups. The

environmentalists, farmers, plantations and partitas, and future researchers will be the beneficiaries of this study by knowing electro culture, and it would help them know which voltage affects the plant growth of tomato plants that can be an alternative way to increase the crop yield. During the experiment, the researchers ran into several problems. The first problem that the researchers encountered was blackout while experimenting. Moreover, the other concern was that the sprout died due to too much heat exposure. After getting all the results of independent t-Tests, the researchers concluded that among all the set-ups, 12 Volts is the most efficient to use for the fast-growing of the plants, for it gives a better outcome in terms of the data that has been collected upon the experiment wherein dependent variables such as the height, weight, colour of leaves and the number of leaves used as the parameters in the study. The researchers have gathered the results of the study of Manguiam et al. (2019), which states that using electro culture; the experiment experienced a decrease in terms of its height. As seen on the results, the different voltages show that there is a lot of significant differences and effect on the height, mass, and colour of the leaves on the brown chickpea plant (Cicer arietinum) and that is how the researchers found 9 V is the best among the three volts. T-test was the most crucial usage as statistical treatment because the researchers saw the effects of the controlled group and the experimental group and identified the significant difference between the experimental and controlled groups. The growth parameters of the treated plants were way greater than the control group, according to the observation of the study.

Table 1- Detailed analysis till day 21

S.no	Units	Average number of leaves	Average number of leaflets	Average shoot height (In cm)	Average stem diameter (In cm)	Distance between 2 nodes (in cm)
1	Control	7	15	14.5	0.6	2
2	A(5V)	9	13	13.5	0.5	2.3
3	B(10V)	11	13	20	0.7	2.1
4	C(12V)	13	15	21	0.6	2.5

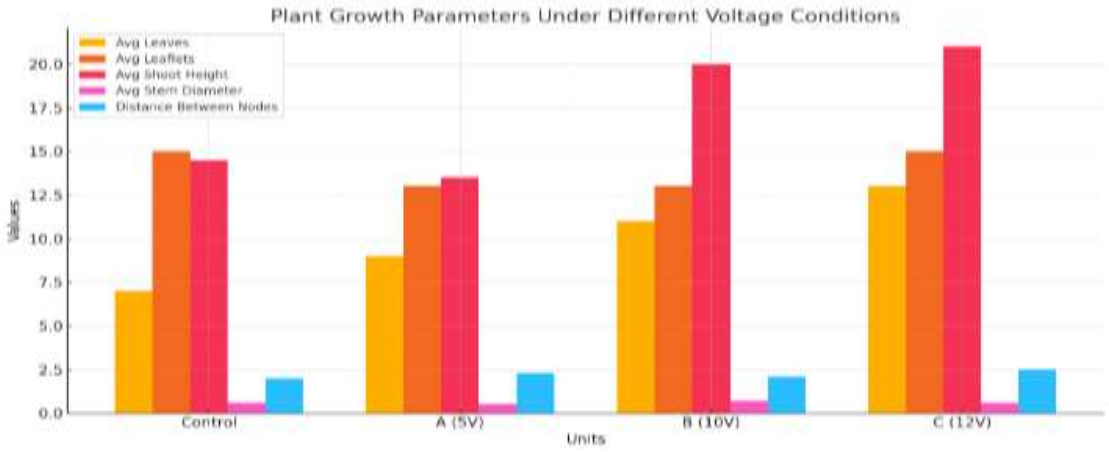

Figure 1- Bar graph showing plant growth parameters under different voltage conditions.

REFERENCES

1. Afrasiyab, A., Zafar, J., Muhmmad, H. (2020). Effect of Electric Field on Seed Germination and Growth Parameters of Chickpea Cicer arietinum L.. Ukrainian Journal of Ecology, 10(4), 12-16.
2. Ahamed, M., Elzaawely, A., & Bayoumi, Y. (2013, May 20). Effect of magnetic field on seed germination, growth, and yield of sweet pepper (Capsicum annuum L.). Retrieved from Asian Journal of Crop Science: https://scialert.net/abstract/?doi=ajcs.2013.286.294.
3. Ahangarnezhad, N., Abbaszadeh, R., & Norouzian, A. (2018). Design and construction of electro-culture system and evaluation of its effect on grass seed (Festuca arandinacea) performance improvement and germination rate. Retrieved from Agricultural Engineering: https://agrieng.scu.ac.ir/article_13526.html?lang=en.
4. Al-Amri, S. M. (2013, October 13). Improved growth, productivity, and quality of tomato (Solanum lycopersicum L.) plant through application of shikimic acid. Retrieved from National Center for Biotechnology Information: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3824136/.
5. Allen, M. (2018, December 19). t-test, independent samples. Retrieved from Sage: https://dx.doi.org/10.4135/9781483381411.n636.
6. Artem, B., & Albertovna, T. (2012). The effect of electricity on plant growth. Retrieved from liceum1535: https://liceum1535.ru/about/conference/papers/1_Barinov_1535.pdf.
7. Barrot, J. S. (2020). Practical research for senior high school revised edition. In J. S. Barrot, Practical research for senior high school revised edition (pp. 171-181). Quezon City: C & E Publishing, Inc.
8. Bewick, V., Cheek, L., & Ball, J. (2004, April 16). Statistics review 10: further nonparametric methods. Retrieved from PubMed Central: 10.1186/cc2857.

9. Cornelissen, J. H. C. (2003). A handbook of protocols for standardised and easy measurement of plant functional traits worldwide. Retrieved from https://www.uv.es/jgpausas/papers/Cornelissen%20et%20al%202003%20handbook.pdf.

10. Craciun, A. P., & Singh, D. (2014, August). A new study of the effects of electromagnetic fields and radioactivity on the growth and health of lima bean plants (Phaseolus lunatus).

11. Retrieved from Vanier college: https://www.vaniercollege.qc.ca/student-research-centre/files/2014/05/lima-bean-plants-study-vrs2.pdf.

12. Doorne, Y. V. (2013). Electroculture, natural energetic forces to increase fertility of the land.

13. Electroculture, Good vibes for Agriculture, 7. Luo, J., Cai, L., Qi, S., Wu, J., & Gu, X. S. (2017). Influence of direct and alternating current electric fields on efficiency promotion and leaching risk alleviation of chelator assisted phytoremediation. Retrieved from pubmed.gov: 10.1016/j.ecoenv.2017.12.005.

14. Frey, B. B. (2018, June %). Pre-experimental group designs. Retrieved from Sage: https://dx.doi.org/10.4135/9781506326139.n536.

15. Fu, E. (2012). The effects of magnetic fields on plant growth and health. Retrieved from Young Scientists Journal: 10.4103/0974-6102.97696.

16. Harold, H. (2007). The Measurement and Value of Plant Height in the Study of Herbaceous Vegetation. Retrieved from http://www.elkhornsloughctp.org/uploads/files/1184264905Heady%201957.pdf

17. Huang, P., de-Bashan, L., Crocker, T., Kloepper, J., & Bashan, Y. (2016, December 23). Evidence that fresh mass measurement is imprecise for reporting the effect of plant growth-promoting (rhizo)bacteria on growth promotion of crop plants. Retrieved from http://www.bashanis.org/wp-content/uploads/2017/01/2017.-Bashan-BFS2.pdf.

18. Huang, W., Ratkowsky, D., Hui, C., & Wang, P. (2019). Leaf Fresh Mass Versus Dry Mass: Which is Better for Describing the Scaling Relationship between Leaf Biomass and Leaf Area for Broad-Leaved Plants? Retrieved from https://www.researchgate.net/publication/331703760_Leaf_Fresh_Mass_Versus_Dry_Mass_Which_is_Better_for_Describing_the_Scaling_Relationship_between_Leaf_Biomass_and_Leaf_Area_for_Broad-Leaved_Plants.

19. Kanimarani, S. M. (2018, October 28). Effect of Seed Exposure to Direct Electrical Current on germination and seedlings growth of three cowpeas (Vigna unguiculata L.) cultivars.

20. Retrieved from zancojournals: https://zancojournals.su.edu.krd/index.php/JPAS/article/view/1640.

21. Luo, J., Cai, L., Qi, S., Wu, J., & Gu, X. S. (2017). Influence of direct and alternating current electric fields on efficiency promotion and leaching risk alleviation of chelator assisted phytoremediation. Retrieved from pubmed.gov: 10.1016/j.ecoenv.2017.12.005.

22. Lazaro, A. K. (2017). The study of the effects of electricity on seed germination and plant growth of contender bush beans. Retrieved from California State Science Fair: http://csef.usc.edu/History/2017/Projects/J1912.pdf.

23. Maffei, M. E. (2014, September 4). Magnetic field effects on plant growth, development, and evolution. Retrieved from Frontiers in Plant Science: haractercountonline.com.

24. Manguiam, V. L. (2009). The effects of electroculture on shoot proliferation of garlic (Allium sativum l.). Retrieved from https://iopscience.iop.org/article/10.1088/1757- 899X/703/1/012009/pdf.

25. Naika, S., Jeude, J. v., Goffau, M. d., Hilmi, M., & Dam, B. v. (2005). Cultivation of tomato: production, processing, and marketing. Retrieved from agromisa: http://www.agromisa.org/wp-content/uploads/Agrodok-17-Cultivation-of- tomato_sample.pdf.

26. Nyakane, N. E. (2019, March 1). The effects of magnetic fields on plant growth: a comprehensive review. Retrieved from International Journal of Food Engineering: doi:10.18178/ijfe.5.1.79-87.

27. Obłuska, E. (2020, June 15). Electrical stimulation of plants for better agriculture. Retrieved from ecoreactor: https://ecoreactor.org/en/electrical-stimulation-of-plants.

28. Ogundare, S., Babalola, T., Hinmikaiye, A. S., & Oloniruha, J. (2015, June). Growth and fruit yield of tomato as influenced by the combined use of organic and inorganic fertilizer in Kabba, Nigeria. Retrieved from eajournals.

29. http://www.eajournals.org/wp- content/uploads/Growth-and-Fruit-Yield-of-Tomato-As-Influenced-By-Combined-Use- of-Organic-and-Inorganic-Fertilizer-in-Kabba-Nigeria.pdf.

30. Patil, M. B. (2018, December 31). Effect of electrocultre on seed germination and growth of Raphanus sativus (L). Retrieved from academicjournals: https://academicjournals.org/journal/AJPS/article-full-text/86D10D559447.

31. Patwardhan, M., & Gandhare, W. (2013). High voltage electric field effects on the germination rate of tomato seeds.