SUMMARY

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Effects on growth-rate of tomato seedlings after treatment with 'Biophoton Therapy Device J. Boswinkel'

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Introduction

This thesis is established and written to report the author's research, including background information and state of knowledge on the associated subject concerning the author's research, biophoton intervention and the influence of that on the germination and growth of stalk length of tomato seedlings (*Lycopersicon Esculentum*).

Tomatoes (*Lycopersicon Esculentum* Mill) are one of the most popular and widely grown vegetable crop in the world, worldwide covering an area of 2.85 million hectares with a corresponding totaled world production of 77.24 million ton, whereas for example, in India it covers an area of 0.31 million hectares with production of 4.6 million ton. Tomato is being cultivated there as an important summer season vegetable crop in low and mid hills of Uttarakhand, Northern India. The fruits are a rich source of Vitamin A, B and C and minerals like calcium, iron, and phosphorus. (FAO,1995)
What Biophotons are and how they work will be explained, starting with photons, then the Biophotons and finally some information on the used 'Biophoton Therapy Device J. Boswinkel'.

1.1 Photons

The modern concept of the photon was gradually developed by Albert Einstein to explain experimental observations that did not fit the classical wave model of light. In particular, the photon model accounted for the frequency dependence of light's energy, and explained the ability of matter and radiation to be in thermal balance (Genuine Observations website).
In physics, a photon is an elementary particle, the quantum of the electromagnetic interaction and the basic unit of light and all other forms of electromagnetic radiation. It is also the carrier for the electromagnetic force.

1.2 Biophotons

Biophotons are weak emissions of light radiated from the cells of all living systems. A photon is a single particle of light. Plants, animals and humans have an intensity of their emission from some hundreds up to one thousand photons/second/cm², and an almost continuous spectrum within the optical range of at least 200 - 800 nm (Bischof, 1995). All organisms, including plants, constantly produce photons as part of their vital activities. A single photon is too faint to be seen by the naked

eye. The weakness of its light can be compared to candlelight at a distance of 20 km. As they appear from living cells, we call them Biophotons. The study field of Biophotons: Biophotonics, is part of Life Sciences, according to the International Institute of Biophysics.(IIB)

1.3 History and Research

Around 1923 the Russian scientist Professor Alexander Gurwitsch discovered an "ultra weak" photon emission from living systems (onions and yeast), since he suggested connections between photon emission and cell division rate. He called this photon emission "mitogenetic radiation" (Bischof, 1995).

In 1974 the German biophysicist Prof. Dr. Fritz-Albert Popp proved the existence of photons. At that time he was looking for ways of understanding the optical properties of the molecule Benzpyrene in relation to carcinogenicity. With Gurwitsch at hand with the mitogenetic radiation research, Popp concluded that if the assumed optical effect of Benzpyrene were correct, then there must be some kind of light source in the cell, and very weak photon ‘signals’ would be able to trigger drastic changes in the behavior of cells.

With Popp's photomultiplier, it was possible to prove that low-level light emissions are a common property of all living cells. The emissions have different intensities for human, plant or animal cells, for different cell types, and can vary from one moment to the next. They are not regular or continually stable, but appear often as "photon explosion" (spikes), especially when the cells are irritated by outside means. (Lillge, 2001)
The Russian scientist A.B. Burlakov repeated the experiments of Gurwitsch in the 90’s and proved that there is Biophoton exchange and influence between fertilized fish eggs that were in optical contact divided by quartz glass filters (Beloussov et al., 2000).

1.4 Coherence

In photosynthesis, where the photons are used to store energy, the coherence is extremely high. Coherence means that the photons can be super positioned, so that the message which is submitted by the photons, becomes very clear (Popp, 1999). The laser-like coherence of the Biophoton field is a significant attribute, making it a prime candidate for exchanging information in a highly functional, efficient and cooperative fashion, lending credence to the idea that it may be the steering factor behind biological processes.
Biophoton emissions will vary according to the functional state of the organism. If a disease affects certain cells they will radiate a different photonic signature than healthy cells of the same type. Thus, Biophotons may be a noninvasive tool for assessing the state of health or vitality. Applications can extend far into other areas like testing food and water quality, checking for chemical or electromagnetic contamination, or agricultural testing for products that improve crop resistance to disease. (Internationan Institute of BioPhysics,IIB,e.V, 2010)

1.5 Biophoton Therapy Device J. Boswinkel (BT)

The research linked with this thesis uses the ‘Biophoton Therapy Device J. Boswinkel’ as a medium to transfer information. According to the inventer and manufacturer this device is said to operate on the following principles:

- Each cell emits Biophotons and they provoke up to 100.000 chemical reactions per second;
- Every living cell emits its own characteristic light pattern;
- When a cell is healthy it emits coherent light, and when a cell is diseased it emits chaotic light;
- Every biochemical reaction is preceded by an electromagnetic signal, the Biophoton, that 'steers' the chemistry of the cell with certain information;
- When the steering signal within the cell is inadequate, then the biochemistry doesn't work properly and the cell will show certain symptoms of disturbance;
- The 'Biophoton Therapy Device J. Boswinkel' corrects the steering signal, which in turn corrects the biochemistry in the cells.

Through past research done by Boswinkel and Van Wijk, it has shown an effect on the Biophoton levels as emitted after treatment with the device. Although this has not been sufficiently documented to use as a reference, it is worth mentioning.
For now, the emission levels are the only means of determining changes in biophoton behavior and/or characteristics.
Together with Dr. R. van Wijk of the University of Utrecht who is also a member of Prof. Popp's team, Dr. Johan Boswinkel performed four experiments in order to determine the influence of the BT device on the quality of milk. There was a significant result, though more research work was advised by Van Wijk.

1.6 Information storage in water

The quality of the water given to plants can have a substantial effect of the growth and health of the plant. This has been shown through research on homeopathy (more commonly with wheat seedlings in later years) and using the theory of 'water memory' postulated by the French immunologist Jacques Benveniste M.D (1935-2004) according to the scientific paper published in the Nature Journal in 1988.

*"Therefore we propose that none of the starting molecules is present in the dilutions beyond the Avogardo limit and that specific information must have been transmitted during the dilution/shaking process."(*Benveniste, 1988)

1.7 State of scientific knowledge of Biophotons in plants

This thesis investigates the influence of the 'Biophoton Therapy Device J. Boswinkel' on growth of tomato seedlings.

The emission of biophotons from plants in the visible range, following a delay time of 2-200 seconds after exposure to light, has been measured in seeds, roots, flowers, leaves, and cells. The biophotonic signals are reproducible and light-induced, thus having a potential link to plant photosynthesis. (Bajpai 1991)

Every living plant emits biophotons. Biophoton emission can be measured with delayed luminescence. Measuring delayed luminescence on plants is done by irradiating the plant with light for a predetermined period of time, and then counting the biophotons emitted by the plant during a period of time.

Biophoton emission can be calculated through mathematical equations. This mathematical equation here shows how the curves and changes in shape are calculated. The delayed luminescence curves of biological tissues, in particular the "hyperbolic" oscillations of the form $\exp(-i \ln(1 + \lambda t))$ with t as the time and λ as a constant, have been subjects of experimental and theoretical investigations. The oscillations are solutions of a Hamiltonian equation that keeps coherent states coherent and can thus be mathematically described as well. In agreement to the expectations the oscillations disappear as soon as a biological system loses its integrity or its collective structure. Photo count statistics (PCS) tests on living matter confirms these results. (IIB, 2005)

Biophotons are elements that operate on a quantum level. Physicists are discovering quantum properties in large collections of atoms and molecules in the nanometer to micro-meter range of plants, particularly when the molecules are packed closely together in the liquid phase. (Institute of Science in Society, United Kingdom). Conventionally, quantum properties are thought to belong to elementary particles of less than 10^{-10}m, while the macroscopic world of our everyday life is 'classical', in that things in it behave according to Newton's laws of motion.

Research question

Is there a difference in the germination and growth properties of tomato seeds, with applied Biophoton treatment, using the 'Biophoton Therapy Device by J. Boswinkel' as opposed to non treated seeds?

Methodology

Design

The application used in this study was the 'Biophoton Therapy Device J. Boswinkel'.

Site

This is a home based study, conducted in Rotorua, New Zealand. It has been done under instruction and guidelines set by the Interuniversity College, Graz/Seggau.

Growth Process

Sixty-four (64) seed beds were used and rinsed twice with distilled water before use. There are two trays per group. The two groups are then potted into the four trays, using soil from the same bag of soil in each cell to avoid any potential differences between bags of soil, since even bags of soil from the same brand might not be exactly consistent in values of nutrients embedded in the soil. Each of these trays have marked columns and numbered rows. Each tray is labeled with a symbol of which only the neutral participant knows the connection to the treatment or control groups, thereby marking each tray with a unique symbol for documentation purposes.

The measurements have been done of the naked stems of the seedlings only, which means that the measurements were up until the first leaf stalk. The focus on stalk length in this study effectively only called for measuring and documenting the stalk length, although it must be noted that the seedlings showed much growth above the first leaf stalk.

Measuring the naked stems up to the first leaf stalk is not necessarily a standard way to measure growth. It was a way chosen by the author to have a general and consistent endpoint to measure to, with the ability to be consistent with as little room for measuring error as possible.

Figure 1: Photo shows the range of measurement used in this study.
All measurements are taken from soil level to the first growth of a leaf stem, as is shown in figure 1. This is the range used in all compiled data in this study.

Measurements have been done and recorded daily throughout the 30 day period. Observations have been made and noted as well for both the treatment and control groups about the statistical growth data.

Participants

- Wendy Boswinkel, Researcher and Author
- K.A. Greenfield (neutral participant for double blinding)
- R.J Hill Laboratories,1 Clyde Street, Private Bag 3205, Hamilton, New Zealand. Contact person; Carole Rodgers-Caroll

Materials

- Biophoton Therapy Device by J. Boswinkel
- 4x seedling cell trays with plastic dome lids, each with individual cells*
- 15 Liters of “Kiwi Garden” seed raising mix (purchased from The Warehouse in Rotorua, New Zealand)
- Distilled water
- 1x Laboratory sample bag
- 1x packet *Lycopersicon Esculentum* tomato seeds, containing 151 seeds in total (brand McGreggor’s)
- 1x 30cm ruler and Tape Measure
- Digital camera

Treatment process

Both the treated group and the control group of untreated seeds consists of 64 seeds in each group (C = control and T = treated). The tomato seeds in both groups have been soaked in distilled water for a period of 8 hours to re-hydrate the seeds.

The T group seeds have then been treated in the water with the 'Biophoton Therapy Device J. Boswinkel' with the program that runs for one (1) minute, with the glass hand rods belonging to the instrument placed in the water along with the seeds. The C group has the glass rods that are attached to the device, placed in the water with the instrument plugged into a power source and switched on, and left in the water with the seeds for the same length of time as per the treated group. The C group is a control group with no additional treatments given, is only soaked in water from the same source and given the same time of one (1) minute with the glass rods in the water with the Device powered on without running the program.

Planting

The documentation noted by the neutral participant was received by the author after the one month growth period. These documentation divulged test and control group trays and their markings, which was planted first, where each was placed in their random positioning.

All seedling trays were placed side by side in the same outdoor environmental and weather conditions. They also remained separated by means of a plastic domed cover.

The daily need for soil moistening was assessed on the basis of drying of the soil during the growth period. If the soil was dry and water was required, a measured amount of 10 ml filtered water was given to all plants at the same time.

Data collection

The growth has been recorded with both photographs and measurements including height stalk and leaf growth of the seedlings. The number of germinated seeds and growth of seedlings the treated and non-treated groups has been documented as well. The stalk growth calculation is done by statistical mean and respectively added as statistical data.

Statistical Analysis

Statistical analysis has been done by a University appointed statistician. This was done so that no potential bias could have entered into the computation and that any perception of bias could be avoided. Data has been collected, was then sent to the statistician to compare and collate a group to group comparison to view the mean and the p value of the growth of the Treatment and the Control groups.

This study was done double-blinded by way of a neutral participant selecting groups for treatment or not and the planting of the seeds. The information was disclosed by the neutral participant at the end of the research term for comparative analysis.

Results

Survey

There was a clear and consistent difference in the germination time between the two groups during the one (1) month period of growth. The control seeds were observed to show a stalk above the soil quicker than the treated seeds and a number of control seeds showed above ground stalk growth two days earlier than the treated seeds. This is the first clear difference between the treated and control

groups. In the Control group there were 55 seeds that germinated successfully out of the 64 seeds planted. In the Treatment group there were 59 seeds that germinated out of the 64 seeds planted. The control group continued to grow at a steady pace and was growing at a faster rate during the first two weeks than the treated seedlings.

There was an identical germination of 22 seeds out of the 24 planted in the germination trays.
From the 21st day of growth on, the T group shows an increase in its speed of growth and in daily percentage of length, surpassing the C group in terms of growth rate in this time section. The C seedlings remained at a consistent growth rate through the entire process.

Where the control group could be seen to show a larger growth rate during the first10 days in the earlier days of the research period, the treated group shows a large amount of coherence in the moment of germination. The control group seeds mainly germinate during a period of 6 days, spread out over those days. The treated group germinates mainly in a much shorter period of time of 3 days.

Variance between the length of the seedling stalk, in the Treatment group, can be seen to diminish from day 19 to day 25, showing a larger variance in length up to day 19 and after day 25.
The entire Control group growth in length seems fairly consistant, that a number of seedlings show a rather low and flat growth rate.

The growth rate percentages of the Treatment group are mainly between 5% to 10%.
The growth rate of the Control group seedlings is primaraly between 3% and 5%.

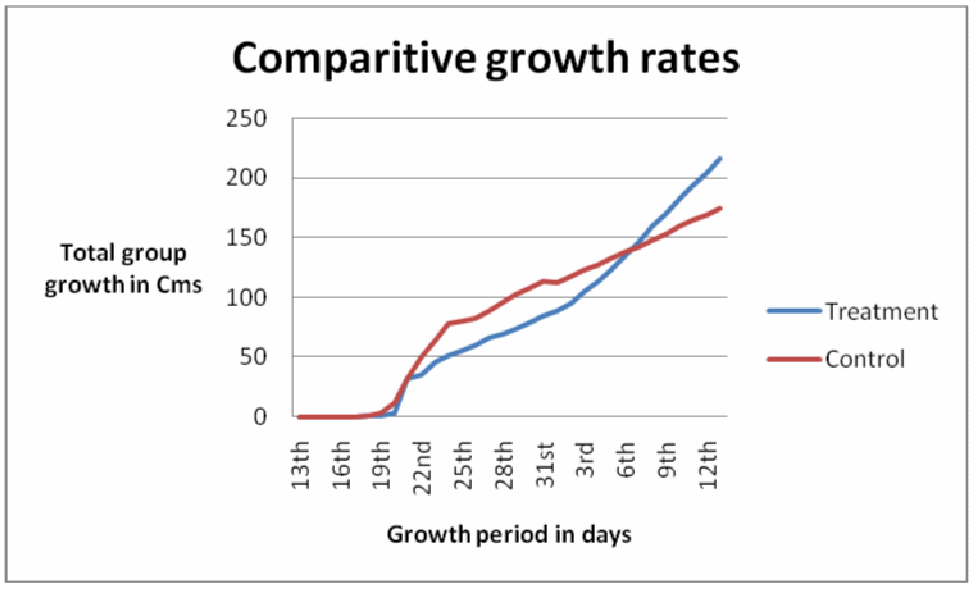

Figure 2: Total growth rates for both Treatment and Control groups. Measured in centimeters

As can be seen in figure 2, there is a difference in the growth timing between the seedlings treated with the Biophoton Device J. Boswinkel, and the Control seedlings. The Treatment group is slower to germinate and begin in the growing phase, and then has a steady increase on the 21st day of growth. The Control seedlings clearly have a faster germination rate, and then decrease in their speed of growth. By day 31 the Treated seedlings have a combined growth of 216cms, the Control seedlings have 174cms in combined growth.

Although there was no overall statistically significant difference in the height of the Treated seedlings as compared to the Control seedlings according to the statistical analysis, noticeable differences could

be seen between both groups. The number of leaves on each plant differed, as well as the color of the leaves and stem and thickness of the stem. The Treatment group showed an increased number of leaves when compared to the Control group, and a deeper green in color of the stems and leaves as compared to the Control groups. The stems of the T group were also thicker and 95% of these were straight in growth. In comparison, the stems of the Control group were less thick and almost all plant stems were very bent.
All of the plants in the Treatment group showed leaves that were longer than the Control group by a mean of 1.5cm. The number of leaves on a plant in the Treatment group was and an average of 4±8 per plant higher than the number of leaves on plants in the Control group.

At the end of the research period, most stems of the Control group seedlings had at least one 90 degree bend in the stem of the seedling. The seedlings were too top-heavy to remain unaided by a stake for support, although the leaves were fewer and smaller than those of the Treated group.
In the Treated group, there were a total of two plants with slight bending of the stem.

Discussion

Interpretation of Results

These research data show that there is a difference in stalk length for tomato seedlings when germinated from seeds that have undergone biophoton intervention by being treated with the biophoton device. The difference shows through the increase in the growth rate of the seedling stalks after initial weeks, deepened leaf color caused by what the author hypothesizes to be higher chlorophyll levels.

Although there is no clear reason for the changes in the growth rate and color of these two seedling groups, the author would hypothesize that there is a change in the biophoton system within the plant cells, as per studies done previously by Popp, Van Wijk and Bajpai. An increase in stem strength when compared to non-treated seeds could be explained by a higher level of quality of the seed and the seedling because of changes in the biophoton characteristics.

Conclusion

From the research, it can be concluded that treatment with the ‘Biophoton Therapy Device J. Boswinkel’ has an influence on seedling growth, growth rate and other aspects like color of the leaves and strength of the stem. The daily mean growth rate of the seedlings grown from treated seeds is consistently higher in the last 14 days of the research period.

The results show a difference, but statistically the difference has not been shown to be significant. The working hypothesis should therefore formally be rejected, and the counter hypothesis formally accepted.

Self-Critical Remarks

The author acknowledges that the seedlings are quite possibly too few in number to get a substantial difference in stalk length. In that light, it would be advisable that follow up research use larger numbers of seeds and seedlings to compensate for any potential natural influences that could decrease the number of valid seedlings.

The author would choose a month earlier in the year to re-do this study to avoid temperature issues reoccurring, although weather is not predictable and can be changeable at any time. Another option would be to perform the research in a plastic or glass house.

Suggestions for Further Research

The results in the data gathered have not lead to the statistical significance that was expected by the author. This would lead the author to believe it would be beneficial to re-do this research with a larger number of seeds, thus having a larger range of possible data to analyze to gain a more clear outcome.

Another suggestion would be to continue the research to a full term study with the tomato plants bearing fruit because of the differences in the last week of growth and the general state of the plants. Even color measurement of the leaves could be introduced as a data collection point. This pilot study was limited to 1 month, but it would quite probably be worthwhile to go on to assess the full length, health, leaf growth and possible yield difference of such tomato plants after Biophoton intervention.
It does leave the author the with the question of what the 'Biophoton Therapy Device J. Boswinkel' does to the plant and its biophoton or physical systems, to make these apparent changes to the state of the tomato seed.

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