Comparative analysis of ultra-weak photon emission in the 380–630 nm band in germinated seeds watered with different waters

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ABSTRACT

This study evaluates the influence of the physico-energetic quality of water on germination processes and ultra-low biophotonic emission (UPE) of Alfalfa seeds (Medicago *sativa* L.). The water samples tested included:(1) mains water, (2) reverse osmosis water, (3) commercial mineral water, and (4) water filtered and revitalized by the OJADE Biophotons 369 system, designed to restructure water via a process combining filtration, vortexing and exposure to coherent photonic fields. The seeds were grown in standard germinators and watered daily with different waters throughout the germination phase. Ultra-weak photon emissions were measured using a Berthold LUMAT LB 9508 luminometer, in the spectral range 380–630 nm. The results show that seeds watered with water from the OJADE Biophotons 369 system exhibit significantly higher biophotonic emission than those watered with other types of water. This increase is correlated with enhanced metabolic and bioenergetic activity, suggesting improved efficiency of oxidative phosphorylation and redox signaling processes. Vitalized water thus appears to act as a coherent carrier of photonic energy, promoting intracellular and intercellular light communication in plant tissues. These observations support the hypothesis that the photodynamic structuring of water can influence biological processes through coherent interactions between the electromagnetic fields of water and those of living systems. Further research is needed to determine the underlying mechanisms and the reproducibility of these effects in other plant models.

Keywords: Biophotons, Biodynamized Water Germinated Seeds, Spectral Range, Luminometer, RLU.

1 INTRODUCTION

1.1 WATER

Water is at the heart of all biological processes. Beyond its role as a universal solvent, it constitutes a dynamic matrix capable of storing, transferring, and transforming energy in electromagnetic form. It represents not only the main constituent of living organisms, but also a vector of information and coherence for all biological systems (Pollack, 2013; Chaplin, 2021).

Water quality directly influences the vital functions of living organisms: nutrient absorption, redox regulation, cellular hydration, and enzymatic metabolism. In recent years, research has broadened the

concept of "water quality" beyond traditional physicochemical criteria to include energetic and structural parameters such as surface tension, redox potential, molecular organization, and ultra-weak photon emission (biophotons), considered a sensitive marker of coherence and vitality (Popp, 1992; Van Wijk & Van Wijk, 2015).

According to the work of Del Giudice and his collaborators, water can exist as coherent domains, where molecules oscillate in unison with the surrounding electromagnetic field, accumulating and re-emitting photonic energy in an ordered manner (Del Giudice et al., 2010). These coherent states give water electrodynamic properties that can influence biochemical and biophotonic processes in living systems.

OJADE Biophotons 369 system is part of this approach. It combines **filtration** and **electrodynamic water vitalization** processes, designed to restore the water's internal coherence and natural energy potential. This type of "vitalized" water is believed to have an increased capacity for transferring energy and information to biological systems, promoting more efficient redox and photonic interactions.

Biophotons — photons emitted spontaneously by living systems at ultra-low intensities — directly reflect the energy state and internal coherence of a biological system.

In living tissues, these emissions result mainly from oxidative or photosynthetic metabolic processes and are correlated with mitochondrial activity and radical reactions (Kobayashi et al., 1999; Rastogi & Pospíšil, 2011).

In contrast, water, a non-metabolic medium, emits photons not because of biochemical reactions, but because of its **internal electrodynamic organization.**

Thus, a stable increase in biophotonic emission in vitalized water, such as that from the OJADE Biophotons 369 system, should not be interpreted as a sign of oxidative stress, but rather as an indicator of **increased photonic coherence,** reflecting a greater capacity for energy structuring and resonant coupling with biological systems.

This study aims to comparatively evaluate the biophotonic emission of waters from different sources (mains water, reverse osmosis water, mineral water and OJADE Biophotons 369 water) in the 380–630 nm spectrum, and to determine their influence on the development of **germinated alfalfa (Medicago sativa) seeds.**

Preliminary results show that seeds watered with OJADE water exhibit significantly higher biophotonic emission, suggesting a direct interaction between the electrodynamic coherence of water and the biological vitality of plant organisms.

These biophotons are identified as energy released in the form of light by changes in energy metabolism.

Research conducted since the 1960s shows that, in addition to the chemical composition of our food, light energy in the form of biophotons is also an important factor in assessing food quality.

1.2 PUBLISHED STUDIES

1. **Mould, RR et al. (2024) — *Ultra weak photon emission — a brief review* .** Recent review summarizing UPE mechanisms, measurement methods, and possible applications in agriculture and food security. Useful for establishing the methodological and conceptual framework. PMC
2. Cifra, M., Van Wijk, E., & Scholkmann, F. (2014) — *Ultra-weak photon emission from biological systems: mechanisms and applications.* Journal of Photochemistry and Photobiology B. Comprehensive
   review explaining how UPE reflects metabolism and oxidative stress and explicitly mentioning potential applications to food quality assessment (freshness, microbial spoilage). ScienceDirect
3. Nematollahi, MA, et al. (2020) — *Ultra-weak photon emission: a nondestructive detection tool for food quality and safety assessment.* Quality Assurance and Safety of Crops & Foods. Review focused on the use of UPE as a non-destructive tool for assessing food quality and safety — covers methodologies, correlations with rancidity, deterioration, and physicochemical parameters. qascf.com
4. Prasad, A. & Pospíšil, P. (2020) — *Spectral Distribution of Ultra-Weak Photon Emission as a Response to Wounding in Plants.* Biology (MDPI). Spectral study on plants showing that the spectral distribution and temporal dynamics of UPE change according to physiological state — technical basis for linking UPE spectrum ↔ quality. PMC +1
5. Jócsák, I., Gyalog, H., Hoffmann, R., Somfalvi-Tóth, K. (2023) — *In-Vivo Biophoton Emission, Physiological and Oxidative Responses of Biostimulant-Treated Winter Wheat.* (Plants, MDPI) Wheat experiment showing correlation between beneficial treatments, physiological improvement, and UPE profiles — UPE as an indicator of vigor and resilience. Useful for the "UPE ↔ quality/germination" argument. PMC
6. Shi, W. et al. (2024) — *An effective method for detecting wheat freshness by integrating machine learning with biophoton analytical technology.* Scientific Reports (Nature group). Direct application: use of UPE measurements combined with machine learning to classify wheat freshness — proof of operational utility in quality control. Nature
7. **Prasad & Pospíšil (2012) / Rastogi & Pospíšil (2011)** — studies on UPE and oxidative stress in plant/human tissues showing the sensitivity of UPE to oxidative processes (useful for distinguishing "stress-induced emission" vs. "vitality-related emission"). ResearchGate +1

8. **Benfatto, M. et al. (2023) — *Biophotons: New Experimental Data and Analysis.* (PMC)** Recent experimental study on germinated seeds and UPE profiles, useful as a modern example of the application of the technique to seeds and quality. PMC
9. **Practical review & meta-analysis resources** : *Biophotonics in food technology: Quo vadis?* (2023) — a review article on optical techniques in food tech, including UPE as a promising avenue. ScienceDirect

2 OBJECTIVE

The objective of this study is to quantify the intensity and rate of biophotonic emission from different water qualities, and then to evaluate their correlation with the biophotonic response of germinated seeds.

In parallel, a comparative analysis of the photonic emission dynamics between the water samples and the germinated seeds is carried out, in order to determine to what extent the photonic energy potential of the water can be transferred or modulated by the plant system.

3 EQUIPMENT USED

The luminometer (Photo 1)

It is important to note that the optical systems of the luminometers used in this study consist of two key elements:

- A lightproof chamber for reading the signal
- A PMT to detect it.

A luminometer is a device used primarily in molecular biology to measure light intensity. It is notably used for studying bioluminescence reactions and for ATPometry.

Light can be quantified, and its intensity expressed in the number of photons. The small number of photons to be measured requires several characteristics:

- The emitted photons must be captured efficiently and transmitted almost entirely to the detector: this is the role of the photomultiplier tube, which "multiplies" the photons using several dynodes;
- The measurement must be carried out in total darkness to avoid any interference;
- The detector's sensitivity must be as high as possible to detect even the smallest photon.

A “luminometer” consists of:

- a light detector that counts photons (photomultiplier tube);
- a light-tight measuring chamber, in which the sample is placed;

- one or more reagent injectors to trigger the reaction (not used in our case);
- An electronic system converts and displays the photon count measurement into relative light units (RLU) on a screen. The RLU value indicates the number of photons emitted per second per square centimeter.

A Berthold luminometer, model LB 9508 (Figure 1), was used for the measurements in this study. This model incorporates a high-sensitivity photomultiplier tube (PMT). It is a low-noise photomultiplier tube operating in single-photon counting mode in the spectral range of 380 to 630 nm.

The units of measurement are expressed in RLU (Relative Light Units).

The Berthold Lumat LB 9508 luminometer, equipped with a high-sensitivity photomultiplier, is capable of detecting light intensities below 10^{-16} W/cm².

The water samples were placed in borosilicate glass test tubes to avoid any optical interference or spectral contamination.

A specific optical filter from 435 to 500 nm was installed on a cuvette of the Lumat LB 9508 to target the blue-green range, the area corresponding to flavin fluorescence (FAD) and mitochondrial photoenergetic response.

- Sensitivity: High-sensitivity model: <1 amol ATP/tube, <1 zmol firefly luciferase
- Optical system: photomultiplier tube
- Detector(s): Low-noise photomultiplier tube operating in single-photon counting mode
- Dimensions: (L x W x H) 24 x 28 x 22 cm (or 9.4 x 11 x 8.7 inches)
- Temperature control: Operates between 15 and 35 °C

The device is controlled by the ICE software **(Photos 3)** . It allows single or multiple endpoint measurements, as well as kinetic and scanning measurements.

The data is displayed in numerical and graphical form and can be exported to Excel or printed.

No reagents were used in the measured samples, so only the natural autoluminescence of each product was detected.

Figure 1

Berthold Lumat 9508 Luminometer

Source: Prepared by the authors

3.2 SPROUTED SEEDS AND TIERED GERMINATOR

(Photos **2 and 3)**: **10 grams of** Germline organic alfalfa seeds per tray containing the different waters (Photos **4 and 5)**

- Germination rate greater than 95%.
- Start germination in each seed tray with 100 ml of water.
- Water the seeds daily by spraying 10 ml per tray
- Germination time: 6 days

Figures 2 and 3

10 grams of Germline organic alfalfa seeds per tray containing the different waters

Source: Prepared by the authors

Figure 4

Germline organic alfalfa seeds per tray containing the different waters

Source: Prepared by the authors

Figure 5

Germline_organic alfalfa seeds per tray containing the different waters

Source: Prepared by the authors

4 METHODS AND PROTOCOL

The experiments were conducted in a laboratory room maintained at a minimal ambient lighting level to reduce any external optical interference. The water samples (3.5 mL) were transferred into borosilicate glass test tubes and then individually introduced into the luminometer for recording biophotonic emissions.

Each test tube underwent a preliminary measurement under vacuum to determine its own photon background noise. This value was then subtracted from the experimental measurements for each sample.

The luminometer's dark chamber was previously calibrated to ensure the stability, linearity, and reproducibility of measurements over time.

5 RESULTS WITH THE LUMINOMETER

5.1 WITH THE LUMINOMETER

The luminometer allows us to have a representation of the emission level and light intensity of biophotons (quantities of biophotons emitted per cm2 / second) contained in the water.

The value is expressed in RLU (relative units of light).

RLUs are universal units of measurement used for most luminescence measurements.

The luminometer is equipped with a photomultiplier tube (PMT) used to detect individual photons. When photons strike the photocathode located at the entrance of the PMT, they release electrons by the photoelectric effect.

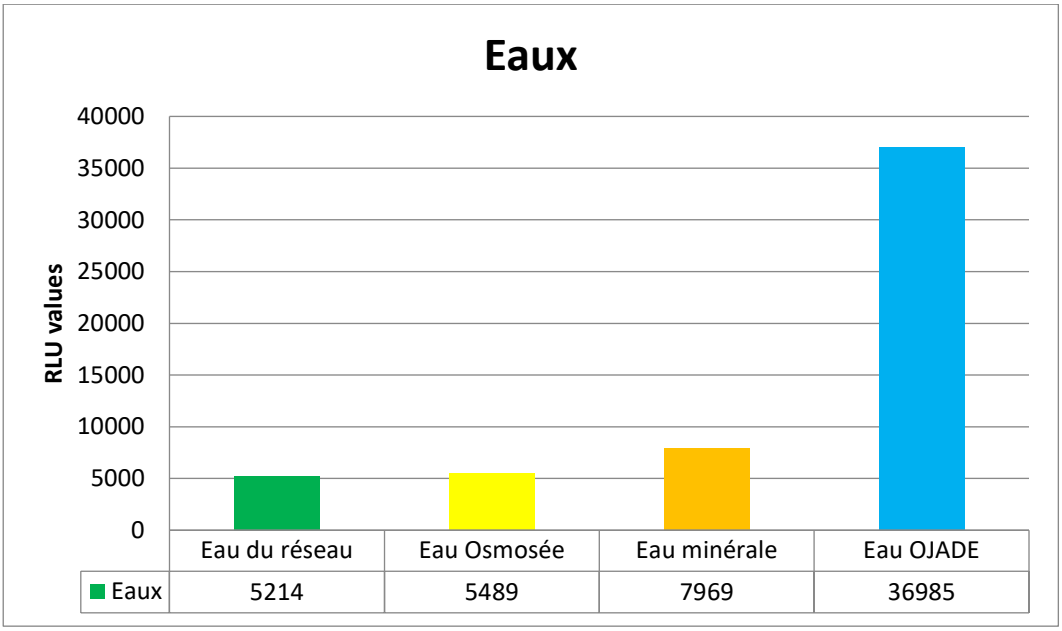
These electrons are then accelerated by a high-voltage electric field and multiplied by a series of dynodes through secondary emission, before reaching the anode connected to the reading circuit.

The signal captured at the anode is converted either into discrete pulses when the PMT operates in photon counting mode, *or into* a continuous analog current when it operates in *current mode.*

Although the use of relative units may be problematic in some areas, it is perfectly acceptable in most life science applications, as they are primarily linked to a control and treat all results relative to that value.

Figure 6

Comparison of biophoton emissions in different types of water and their biophotonic consequences



Source: Prepared by the authors

5.2 WITH TDS

5.1.1 Using the TDS (Total Dissolved Solids) meter

The TDS (Total Dissolved Solids) of water measures the total amount of solid particles other than water molecules (H_2O).

This is expressed in PPM (parts per million).

These particles are of all kinds: minerals, bacteria, viruses, heavy metals, chlorine, other organic and inorganic particles.

1. Tap water:
   Conductivity: 211 ppm
   Temperature: 17°C
2. Vitalized water thanks to the Biophoton 369 system:
   Conductivity 18 ppm
   Temperature: 20.3°C
3. Bottled mineral water:
   Conductivity: 385 ppm
   Temperature: 18°C
4. Osmosis water:
   Conductivity: 27 ppm
   Temperature: 18°C

6 CONCLUSION

The results suggest that germinated seeds are capable of **modifying the energy and photonic structure of absorbed water,** even when it initially exhibits low photonic activity. This phenomenon indicates that **biological systems can amplify or reorganize the photonic properties of the aqueous medium,** leading to the emergence of a **coherent optical signal,** regardless of the water's initial state. However, water with **higher intrinsic biophotonic activity** appears to facilitate this energy transfer process more efficiently.

The **amplification of photonic emission** observed in seeds watered with water treated by the OJADE Biophotons 369 can be interpreted as reflecting a **higher level of energy organization and functional coherence** of the living system, potentially linked to its **increased metabolic activity** and **redox balance.**

These observations suggest a **transfer of photonic information** between the vitalized water and the biological system, with the seed appearing **to store and re-emit light energy** in proportion to that transmitted. Conversely, waters exhibiting low or no photonic emission seem to lead to primarily endogenous emission, resulting from the intrinsic biochemical activity of the seed—a situation that may imply **compensatory energy mobilization.**

Further spectral and kinetic analyses will be needed to **characterize this photonic coupling** and its functional role in germination processes in greater detail.

Biophotons, defined as ultra-weak emissions of photons in the visible to near ultraviolet range, spontaneously generated by living systems, constitute a **sensitive biophysical indicator** of the state of organization and **electrodynamic coherence** of the biological system (Popp & Li, 1992; Van Wijk & Van Wijk, 2005; Cifra et al., 2015).

These emissions originate from **redox reactions and electronic transitions** involving active biomolecules, reflecting the **internal energy dynamics** and the **degree of thermodynamic order** of the system (Cifra & Pavlík, 2019).

In this study, comparative analysis of different water samples reveals a **positive correlation between the intrinsic photon intensity of the water and that subsequently measured on germinated seeds** hydrated by these samples. This relationship suggests a **partial transfer of photon coherence** or **resonant induction** between the aqueous medium and the biological system, consistent with the **coherent electrodynamic coupling models** proposed by Del Giudice et al. (1988) and Fels (2009).

According to these models, water acts as a **structured dipolar medium** capable of forming **quantum coherence domains** , within which electromagnetic oscillations and molecular dipoles interact in a synchronized manner (Del Giudice et al., 2010). Water exhibiting **more intense photonic emission** could thus manifest a **higher degree of molecular order** and an **enhanced ability to interact coherently** with living systems.

From this perspective, the results of this study **support the hypothesis** that **biophotonic radiation** is not only a by-product of metabolism, but also a **direct indicator of the electrodynamic coherence and overall energy potential** of a biological system (Popp et al., 2011; Van Wijk et al., 2014).

7 GENERAL DISCUSSION

Several exploratory studies have suggested that water, when subjected to certain energizing or electromagnetic treatments, could form metastable supramolecular coherence states. For example, Elia and Napoli (2010) proposed that water coherence domains (CDs) could be excited and stabilized by various weak perturbations, paving the way for further structuring of water. Furthermore, Musumeci et al. (2010) observed delayed luminescence in ionic aqueous solutions under certain conditions, which could indicate alterations in the molecular organization of water. Although experimental demonstration of vortex creation or low-frequency excitation applied to water remains limited, this work provides a conceptual framework for considering that magnetic fields or weak excitations could influence the coherence state of water.

- A publication entitled *"Aqueous ionic solutions studied by time-resolved delayed luminescence,"* by Musumeci F., Grasso R., Lanzanò L., et al., published in *WATER Vol. 2 Suppl. 1, 2010,* deals with aqueous ionic solutions and time-resolved luminescence. Water Journal
- A study by Elia and Napoli (2010) entitled *"Water dynamics at the origin of metamorphosis in living organisms"*, published in *Water* 2010, 2, 566-586 -, deals with the coherence domains of water and its supramolecular organization.

From a biophysical point of view, these states are interpreted as ordered configurations of photons and water dipoles, capable of storing energetic information (Popp & Beloussov, 2003).

These results open up important perspectives for understanding the quantum role of water in bioenergetics, metabolic regulation, and intercellular photonic communication.

Several scientific hypotheses can explain the stronger emission observed with the Biophotons 369 system:

1. Increased water structuring

- Energizing devices, such as the Biophotons 369 system, can induce a reorganization of H_2O molecular clusters.
- A more ordered structure promotes resonance and electromagnetic coherence between water molecules, thus facilitating photonic emission.

2. Increase in quantum coherence

- According to the work of Del Giudice, Preparata and Montagnier, water can form coherence domains where molecules oscillate in unison.
- More coherent water can accumulate more energy in the form of internal electromagnetic fields, then release that energy as coherent photons.

3. Reduction of thermal noise and energy losses

- The mains water, subjected to pressure, chlorine and electromagnetic disturbances, presents a more chaotic state.
- Vitalized or energized water, on the other hand, exhibits better stability and a more structured photonic field, resulting in increased and more harmonious emissions.

4. Role of the vitalization system

- The device could serve as an energy or frequency information transmitter, thus modulating the internal electromagnetic field of the water.
- This "information" stimulates the photonic resonance capacity of water, thereby increasing its spontaneous emission in the visible or near UV range.

The results demonstrate that water revitalized by the Biophoton 369 system generates more biophotons than tap water. The difference is highly significant; these results confirm, from a biophotonic perspective, the effect of revitalization on water.

Proposed interpretation to understand the results observed on germinated seeds

1. The water is absorbed by the seed.
2. Mitochondria and membranes excite the surrounding water via electrodynamic resonances and dipolar interactions.
3. The water becomes structured into coherent domains, capable of storing and releasing energy in the form of photons.
4. THE the emitted biophotons reflect active metabolism and energy potential of grains.

It appears that germinated seeds transform absorbed water, even when its initial photonic activity is low, into a medium exhibiting measurable biophotonic emission.

This suggests that living systems can amplify or modify the photonic properties of water, leading to the emergence of a coherent optical signal, regardless of the initial state of the medium.

Water with higher intrinsic biophotonic activity appears to facilitate this transfer more efficiently.

We interpret the amplification of photonic radiation from germinated seeds watered with vitalized treated water as a reflection of a higher level of energetic organization and functional vitality of the system, possibly linked to its metabolic activity and redox balance.

The experiment suggests a transfer of photonic information from the water treated by vitalization to the germinated seeds, which seem to retain it proportionally to the energy transmitted.

Conversely, in waters with low or no biophotonic emission, the photons are likely produced by the seed's own biochemical activity, which could divert energy away from other biological processes. Further analyses will be needed to elucidate this mechanism.

Biophotons, defined as emissions of ultra-weak photons in the visible to near ultraviolet range generated spontaneously by biological systems, constitute a sensitive biophysical indicator of the state of organization and functional coherence of living systems (Popp & Li, 1992; Cifra et al., 2015; Van Wijk & Van Wijk, 2005).

These emissions result mainly from redox reactions and electronic transitions within biomolecules, reflecting the internal energy dynamics and the degree of thermodynamic order of the system (Cifra & Pavlík, 2019).

In this study, comparative analysis of different water samples reveals a correlation between the intensity of intrinsic biophotonic radiation in the water and that subsequently measured on germinated seeds hydrated by these same samples.

This observation suggests a partial transfer or induction of photonic coherence between the aquatic environment and the biological system, a mechanism consistent with the electrodynamic coupling models described in the biophysics of coherent fields (Del Giudice et al., 1988; Fels, 2009).

In this context, water can be considered as a structured dipolar medium capable of forming quantum coherence domains where electromagnetic oscillations and molecular dipoles interact in a synchronized manner (Del Giudice et al., 2010).

Water exhibiting higher photonic emission could thus demonstrate an increased degree of molecular order and an enhanced ability to interact coherently with living systems.

These results support the hypothesis that biophotonic radiation is not just a by-product of metabolism, but a revealing parameter of the electrodynamic coherence and energy potential of a biological system (Popp et al., 2011; Van Wijk et al., 2014).

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