

Original Research

The effect of MRET activated water on plants

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ABSTRACT:

This particular article relates to the study of the effect of MRET Activated water on growth and development of higher plants. It provides some evidence that MRET Activated water with the modified physical and electrodynamic characteristics may enhance specific molecular mechanisms in living cells of botanical origin. In particular, the discovered change (a reduction) of the viscosity of activated water should influence essentially the movement of cellular juice in the vessels of *xylem* and *phloem*. Change of the conductivity and the dielectric permittivity should render a strong influence on the movement and the characteristics of ions in water. The living cells of botanical origin have rather complex structure, consisting of the folding membranes, the specialized connections, and organelles. The localization of ions is particularly important, since each of the complex structures must be expected to have a specific role in the electrical function of the cells and as a result it may affect plants germination and development. To verify the validity of the proposed hypothesis the study on higher plants was conducted at the Institute of Cellular Biology and Gene Engineering of the National Academy of Sciences of Ukraine.

Keywords:

Viscosity, dielectric permittivity, germination; plant, root system, MRET Water.

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INTRODUCTION:

Water makes up about 90% of all the contents of plant cells. Alongside macro- and microelements, it is a necessary part of any soil mixture for the cultivation of plants under natural conditions, as well as the cultural medium for the cultivation of plants under sterile conditions. In the vessels of *xylem* and *phloem* and in the lactifers of higher plants, there is a kind of vegetative juice, which is analogous in function to blood plasma of higher animals and even human. The composition of this juice includes a big complex of organic substances and inorganic elements. The composition and concentration of these substances and elements differ strongly not only in different plants, but also in different parts of the same plant. The main characteristic that unites all kinds of cellular juice is the large content of water which reaches 98% in relative concentration. With the lack of water, all growing processes are violated, which can cause the death of plants. We may say without exaggeration that water is the main component of any plant, and its presence is the main condition for the plant's existence as a living being. This implies at once that water is the main element of a biological system, whose influence allows one to realize the strongest influence on this system. Thus, the introduction of water with any 3 particular characteristics into soil (irrigation) or into a cultural medium will definitely influence the basic growing parameters of plants. Such water can render a positive or negative influence on all developmental phases of a plant, including the peculiarities of the germination of seeds (speed of germination, percentage of germinating capacity), the growth of the over ground part of a plant e.g. a sprout (the growth of its height and weight), and the growth of a root system. It can also influence the size of leaves (the area of a leave surface), and can cause the appearance of a typical (by their form, size, and color) leaves.

The studies of the influence of MRET activated water on plants were carried out under the supervision of

N.A. Matveeva, Ph.D. at the Institute of Cellular Biology and Gene Engineering of the National Academy of Sciences of Ukraine.

In addition to the results of studying the influence of MRET activated water on the growth of plants under natural conditions, we also discuss here its influence on the growth of sterile cultures under conditions of a special cultural medium.

The usage of sterile cultures for the study of the influence of MRET activated water is caused by certain circumstances, among which the most important is the increase of reliability and authenticity of the obtained results. The point is that a sterile culture does not practically contain any bacteria.

Therefore, the influence of extraneous factors (for example, infection or contamination) is practically excluded. This circumstance allows us to judge the direct effect rendered by the additional factors connected, in particular, the usage of activated water. The results of studies of the physico-molecular properties of MRET activated water stated below allow us to predict the influence of water activation on the development of plants. In particular, the discovered change (a reduction) of the viscosity of activated water should influence essentially the movement of cellular juice in the vessels of xylem and phloem. Change of the conductivity and the dielectric permittivity should render a strong influence on the movement and the characteristics of ions in water (Smirnov, 2007, 2008).

Thus, investigating some key parameters, which characterize the growth of plants, allows us to make certain conclusions about the influence of some particular properties of MRET activated water on plants and, eventually, to find the optimum ways of using such water.

METHOD AND MATERIALS:

The different kinds of plants were used in the experiments to investigate effects of MRET activated

water. These systems can be represented by two hierarchical levels:

- higher plants grown in a nutritious medium;
- higher plants grown in a soil;

The influence of MRET activated water (activated for 30 minutes and 60 minutes respectively) on the growth of plants in soil and under conditions of a sterile cultural medium was investigated in these experiments. Water was activated directly before its usage or it was kept after the activation in a cooler at a temperature of 4°C no longer than one day. Control plants were irrigated with similar, non-activated water.

To prepare sterile culture, a sterile concentrate of the medium was prepared beforehand, which was then diluted with distilled water and which was later activated. In order to study the influence of activated water on higher plants, sterile higher plants such as *Solanum tuberosum* of grade “Lugovskoi” and *Solanum rickii* capable of growth in sterile cultural media (in sterile test tubes) were used as the object of study. The Murashige–Skoog standard sterile cultural medium (Murashige and Skoog, 1962) was prepared for the growth of plants. For the preparation of an agar-based medium, we took one part of ordinary distilled water and four parts of the corresponding MRET activated water.

Firstly, a concentrated solution of the cultural medium dissolved in a small amount of ordinary distilled water was prepared. After sterilization and cooling, this solution was diluted with the corresponding fraction of activated water in the ratio of 1:4. In such a way, the cultural medium was enriched with a specific fraction of activated water by 80%. For the use of the liquid cultural medium, it was activated for 0.5 h or 1 h after the sterilization process directly in sterile test tubes under conditions of a sterile box. To preserve the sterility of experiments, special measures were undertaken. In particular, in the case of a liquid cultural medium, it was activated after the sterilization directly in sterile test

tubes. Control and experimental plants were cultivated under identical conditions of illumination and at the same temperature. In test tubes with the sterile medium, the parts of plants (shoots) having one bud were sown. Plants were cultivated in the presence of light at a temperature of 20°C with the following light/dark period within each day: 16 h of light - 8 h of darkness. In three weeks after the sowing, the evaluated plants were taken from test tubes, and the measurement of their major parameters: the 5 height of plants, weight of the over ground part, and weight of leaves was carried out, and the surface area of leaves were evaluated as well (Vysotskii *et al.*, 2009).

In addition, after the completion of each experiment, the following coefficients of action of activated water which characterize the average parameters of evolved plants were determined:

1. **Coefficient of inhibitory action of activated water on the growth of plants in the sterile culture**
 $K_1 = N_{1a} : N_{1c}$. Here, N_{1a} is the amount of segments survived from the cultivation in the medium with MRET activated water, and N_{1c} is the amount of segments survived from the cultivation in the control medium.
2. **Coefficient of stalk formation** $K_2 = N_{2a} : N_{2c}$. Here, N_{2a} is the amount of segments, of which sprouts in the medium with MRET activated water were formed, and N_{2c} is the amount of segments, of which sprouts in the control medium were formed.
3. **Coefficient of the length of formed sprouts**
 $K_3 = L_a : L_c$. Here, L_a is the average length of the sprouts formed on one segment cultivated with activated water, and L_c is the average length of a sprout formed on one segment in the control.
4. **Coefficient of a change of the coloring of leaves**
 $K_4 = N_{4a} : N_{4c}$. Here, N_{4a} is the amount of plants with atypical coloring of leaves in the medium with MRET activated water, and N_{4c} is the amount of plants with atypical coloring of leaves in the control

medium.

5. **Coefficient of root formation** $K_5 = N_{5a} : N_{5c}$. Here, N_{5a} is the amount of segments, on which roots were formed in 3 weeks of the cultivation in the medium with MRET activated water, and N_{5c} is the amount of segments on which roots in the control medium were formed.

For the study the influence of different fractions of MRET activated water on the germination of seeds and the formation of leaves, seeds of the following vegetable crops were used: radish “Red giant” and “Krasa rannyaya”, peas “Alpha”, string beans asparagus “Valentino”, cabbage of grade “Dymerskaya” and pumpkin of grade “Zhdana”.

Test Results

The growth of plant *Solanum tuberosum* (one plant in a separate test tube for each fraction of MRET activated water and for the control one) was investigated to study the influence of MRET activated water. To get reliable data and the necessary statistics,

we carried out each experiment simultaneously (in parallel) as a series of 11 recurrences. In general, 33 plants were studied. For a plant *Solanum rickii*, the study was carried out according to an analogous scenario (one plant in a separate test tube for each fraction of MRET activated water and for the control one) with the use of a series of 20 recurrences. In total, 60 plants were studied. The data of experiments, the metrological parameters of evolve plants *Solanum tuberosum* of grade “Lugovskoi”, and the general view of evolve plants are presented in Figs. 1 - 2, and in Tables 1-2 respectively.

To study the influence of different fractions of MRET activated water on the germination of seeds and the formation of leaves, the seeds of the following vegetable crops were used: radish “Red giant” and “Krasa rannyaya”, peas “Alpha”, string beans asparagus “Valentino”, cabbage of grade “Dymerskaya” and pumpkin of grade “Zhdana”. These seeds were sown into compositionally similar soil and were periodically irrigated with a certain fraction of water. The study of the

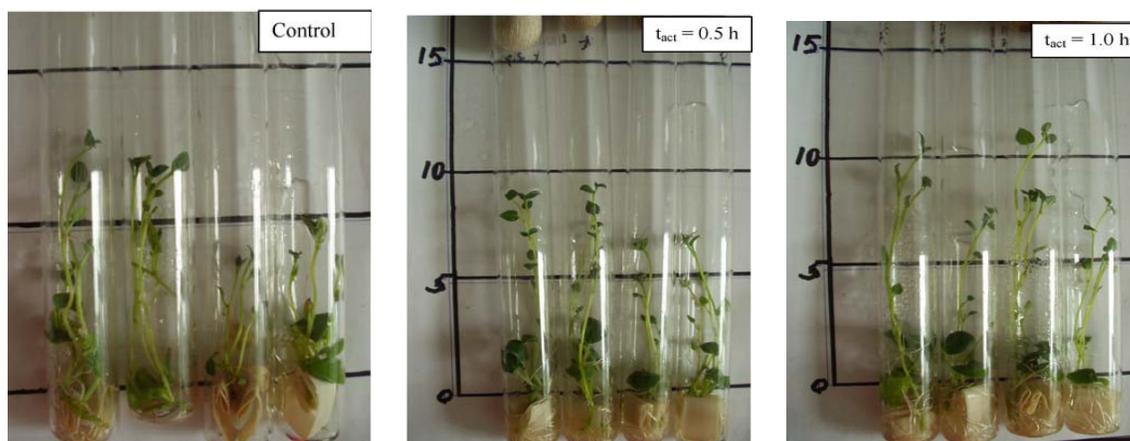


Fig 1. The view of sterile higher plants *Solanum tuberosum* in test tubes in the sterile cultural medium based on MRET activated water and regular control) water after three weeks cultivation period of time.

Table 1 Influence of MRET activated water on the growth of sterile higher plants *solanum tuberosum*.

Fraction of Water	Average height of a plant	Average weight of the over ground part of a plant	Average Weight of leaves of a plant	Average area of leaves of a plant
$t_{act} = 1.0$ h	7.8 cm	0.072g	0.013g	0.93 cm ²
$t_{act} = 0.5$ h	6.8 cm	0.068g	0.014g	1.00 cm ²
Control	4.4 cm	0.058g	0.013g	0.93 cm ²

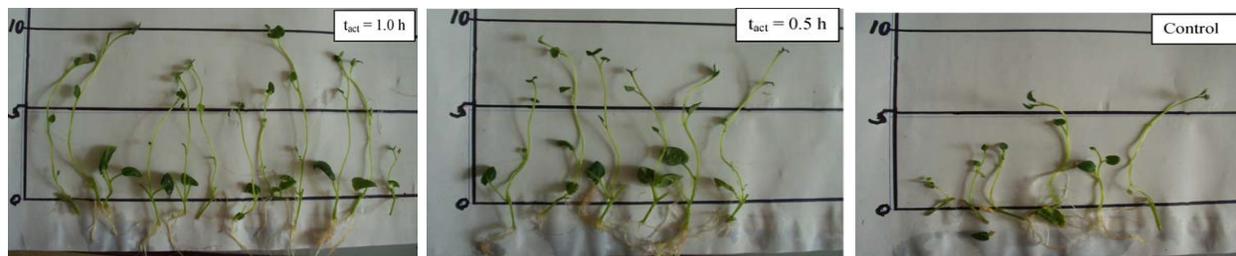


Fig.2. Sterile higher plants *Solanum tuberosum* taken from test tubes after three weeks cultivation period of time in the sterile cultural medium based on MRET activated water and regular (control) water.

Table 2 Coefficients of action of MRET activated water on the growth of sterile higher plants *solanum tuberosum*

Fraction of Water	K1	K2	K3	K4	K5
$t_{act} = 1.0$ h	1	1	1.77	0	1
$t_{act} = 0.5$ h	1	1	1.54	0	1

germination of above-mentioned vegetable seeds irrigated with two different fractions of MRET activated water and regular water has shown that, practically for all tested plants (except for string beans), irrigation with water activated for 60 min promoted a much faster germination of seeds at the initial stage. The example of such stimulating influence of MRET activated water on the germination of seeds of radish “Red giant” for the first 10 days is presented in Figs. 3-4. Thirty seeds were sown in a Petri dish. The first shoots of this plant have appeared in all variants in four days after sowing. The sequence and characteristics of the seed germination are presented in Table 3-4.

It is clear that the usage of MRET water activated for one hour renders a very large stimulating effect on vegetable crops at the beginning of the cultivation period. In 10-20 days after the beginning of the cultivation, the effect of the stimulation was noticeably reduced, and the final difference between the

numbers of sprouts using activated and 10 control (non-activated) water was insignificant. It is found that water activated for 0.5 h increased the number of sprouts in comparison with the control for radish and peas. In 10-20 days of the cultivation, the effect of MRET activated water ($t_{act} = 0.5$ h) on the development of plants was similar to that of water activated for one hour.

The photos given in Figs 3-5 and the data presented in Table 3-4 allows to conclude that the activation of water renders essential stimulating influence and promotes a much earlier germination of radish seeds. The strongest effect of stimulation corresponds to MRET water activated for 1 hour.

CONCLUSION:

MRET-activated water is produced with the help of a patented in the USA Molecular Resonance Effect Technology (MRET). The MRET water activator is the stationary source of a subtle, low frequency, resonant electromagnetic field with a composite structure. The origin of the low frequency composite electromagnetic field is the intensive electrical activity inside the nano-circles formed by linear molecular groups of the MRET polymer compound when the polymeric body is exposed to the external electromagnetic fields.

Table 3 Germination of seeds of radish “Red giant” irrigated with MRET activated and control (regular) water

Fraction of water for irrigation	Number of sprouts in 4 day after sowing	Number of sprouts in 5 day after sowing	Number of sprouts in 6 day after sowing	Number of sprouts in 9 day after sowing
$t_{act} = 1.0$ h	15	23	25	28
$t_{act} = 0.5$ h	12	20	22	25
Control	5	14	16	24

MRET Activated water with the modified physical and electrodynamic characteristics may enhance specific molecular mechanisms in living cells of botanical origin. In particular, the discovered change (a reduction) of the viscosity of activated water should influence essentially the movement of cellular juice in the vessels of xylem and phloem. Change of the conductivity and the dielectric permittivity should render a strong influence on the movement and the characteristics of ions in water.

The localization of ions is particularly important, since each of the complex structures must be expected to have a specific role in the electrical function of the cells and as a result it may affect plants germination and development. The analysis of results of the plants cultivation experiments allows to make the following conclusions:

For 25 days of the observation of the growth of sprouts of radish “Red giant”, a gradual and



Fig. 3 Shoots of radish “Red giant” in 4 days after sowing into soil. Immediately after the sowing of plants, the soil was irrigated with ordinary (control) or MRET activated water with the duration of activation of 1 h and 0.5 h.

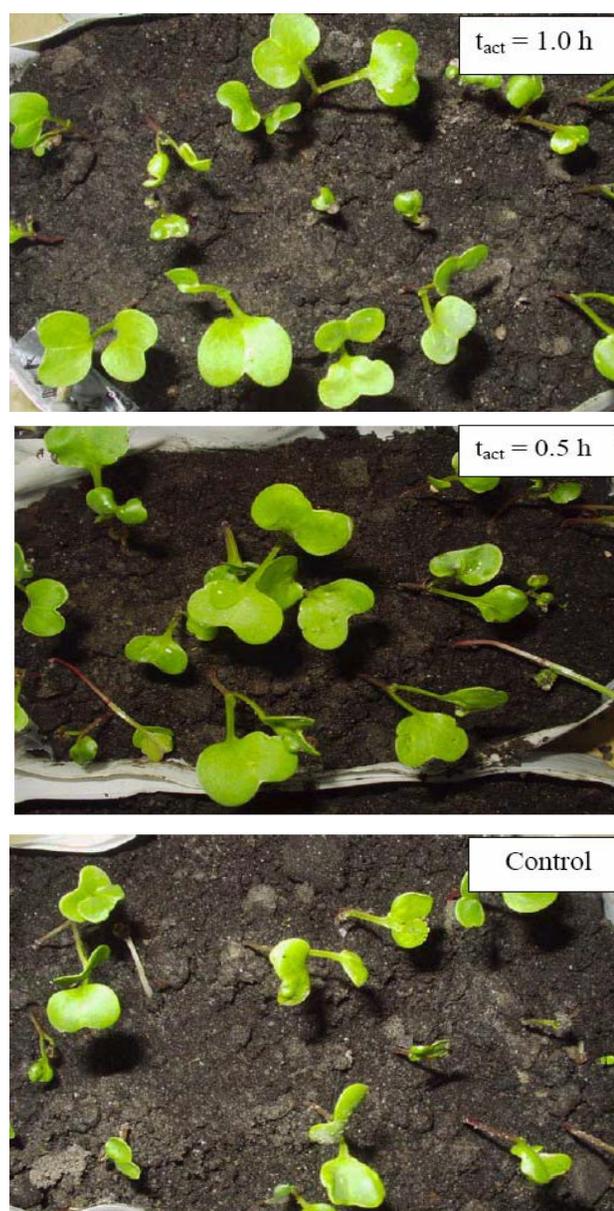


Fig. 4 Shoots of radish “Red giant” in 9 days after the sowing in to soil (soil was irrigated with control and MRET activated water).

Table 4 Characteristics of radish “Red giant” irrigated with MRET activated water compared with control (regular) water in 25 days after the appearance of shoots

Fraction of water	Average height of the over ground part of a plant in 25 days after the appearance of shoots	Average weight of the over ground part of a plant in 25 days after the appearance of shoots	Average area of the surface of leaves of a plant in 25 days after the appearance of shoots
$t_{act} = 1.0$ h	121.9%	157.1%	137.6%
$t_{act} = 0.5$ h	106.9%	103.5%	94.2%
Control	100%	100%	100%

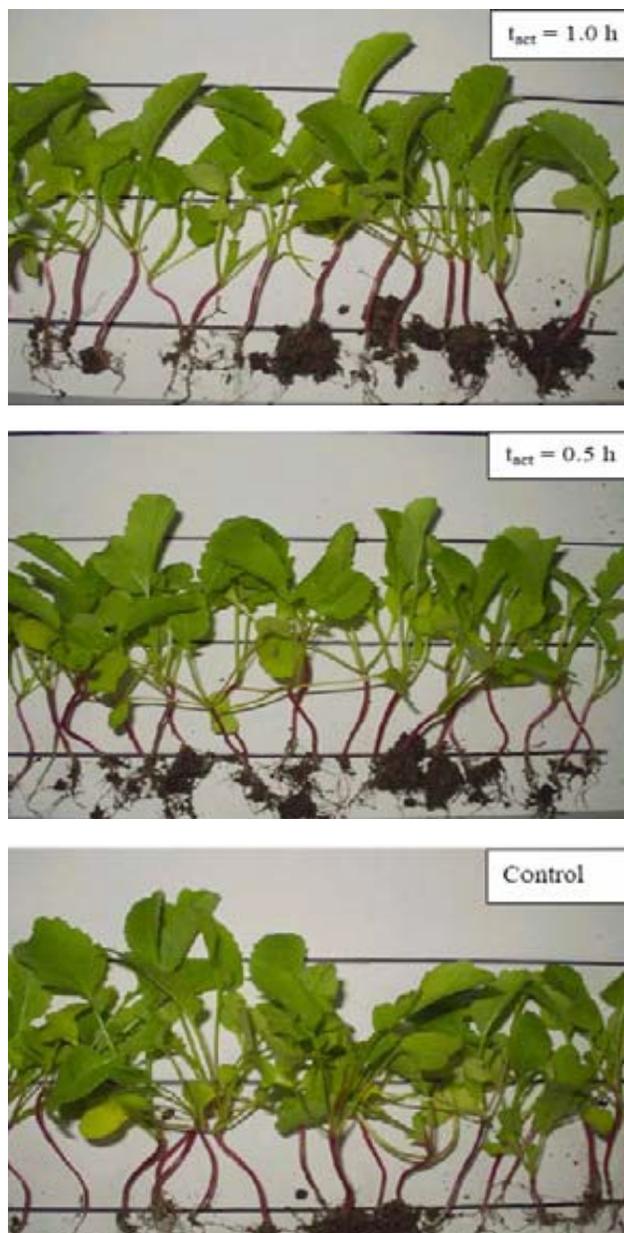


Fig. 5 Plants of radish “Red giant” in 25 days after the sowing.

accumulating change of the intensities of the growth of plants was registered for those irrigated with MRET water activated for 1 h. At the end of the observation period, the plants which were irrigated with such activated water exceeded substantially the control plants in all parameters (as for the increment of the average height of the overground part of a plant by 21.9%, the average weight of the over-ground part of a plant by 57.1%, and the average area of the surface of leaves of a plant by 37.6%). At the same time, the differences between the plants irrigated with MRET water activated for 0.5 h and control plants turned out to be insignificant.

MRET activated water is non toxic for plants of the sterile culture. The survivability of the sowed material in all variants made 100% and did not differ from that in a cultural medium prepared with “regular” water.

MRET activated water does not interfere with the normal growth of the over-ground part of plants and the root system and does not result in the appearance of atypical coloring of leaves.

The average increase in the height of plants by 77.2% and the weight of their over-ground part by 24.1% was observed for plants *Solanum tuberosum* for the growth in the medium with MRET activated water compared to the control samples.

Thus, studying some key parameters, which characterize the growth of plants, allows to make certain conclusions about the influence of MRET activated

water on plants and, eventually, to find the optimum ways of using such water.

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