Practical Magnetology

MAGNETIC TECHNOLOGIES

In Agricultural Sector

MagTech

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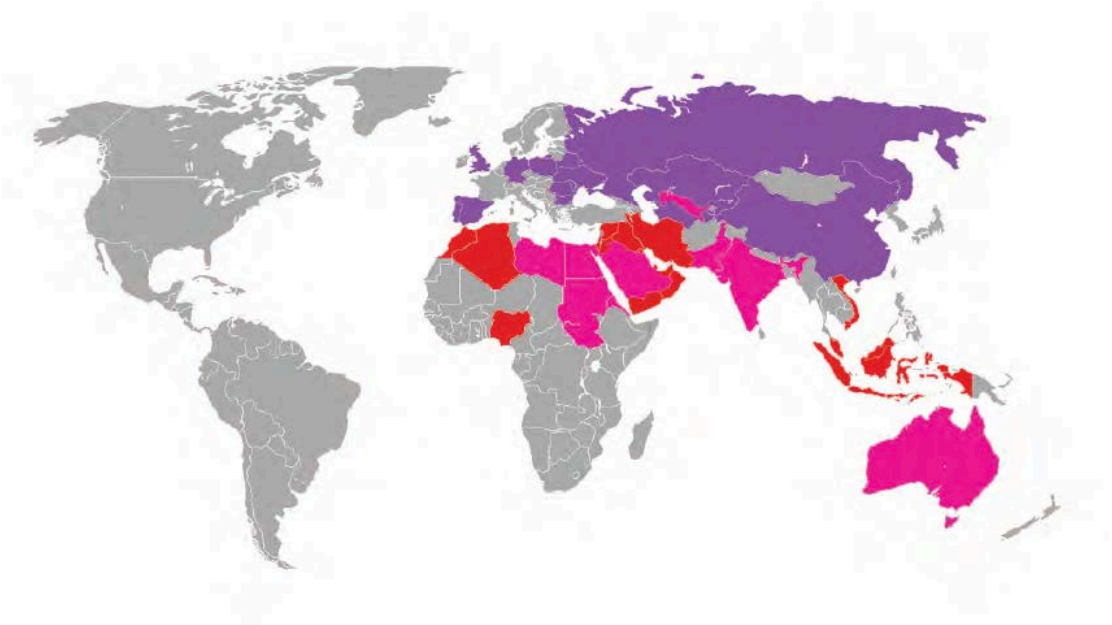
About Magnetic Technologies LLC

Magnetic Technologies was established in 1994, based in Dubai UAE with offices and representatives in Asia, Africa and South-East Asia (Australia, Bahrain, Cyprus, Eritrea, Iraq, Saudi Arabia, Kuwait, Lebanon, Nigeria, Pakistan, Qatar, Sudan and India).

We have developed proprietary technology that harnesses the natural energy found in permanent magnetic fields to create customized solutions for worldwide use in agriculture, energy, municipality and leisure. We have a strong, 20 year track record of success and have proven our results in numerous trials, tests and farm applications globally.



reports on applications of magnetic technologies

researhes and applications of magnetic technologies

active applications of magnetic technologies

Benefits of using magnetic technologies

Agricultural Benefits
Following years of extensive scientific research, we have created magnetic technologies to enhance agricultural resources, resulting in multi-fold commercial and environmental benefits:

- **30-50% reduction in seed usage.**
- **15-30% increase in crop yield and better quality produce, some crops double.**
- **Reduction of vegetation period by up to 15 days.**
- **Doubles shelf life of produce (given the same storage conditions).**
- **Reduction in use of fertilizer by up to 50%.**
- **30-50% reduction in water used for irrigation.**
- **Enables soil desalination.**
- **Allows to use of brackish water for irrigation.**
- **Minimizes use of pesticides and herbicides.**

Animal Breeding
Magnetized drinking water has the following effect on animals:

- **Significant reduction of morbidity and mortality.**
- **Increase of average daily gain by 15-30%.**
- **Increase in milk yield and milk fat.**

Poultry Farming
- **Increase in egg production.**
- **Increase in average daily gain of weight.**
- **Significant reduction of morbidity and mortality.**

Fish Farming
- **Fish growth doubles.**
- **Water reservoirs can be used for irrigation.**
- **Significant reduction of morbidity and mortality.**

Water Reservoirs

- **Neutralize pathogenic bacteria.**
- **De-gazation of unpleasant smell.**
- **Reduction of weighed particles.**
- **Increase amount of dissolved oxygen in water.**
- **Kills mosquitos and flies.**

Introduction to Magnetology

The magnetic field (MF) is a special form of matter in motion, which enables communication and interaction between the flows of electric charges. MF is forces of attraction of moving opposite charges and one-directional currents and vice versa, repulsive forces of moving same charges and multidirectional currents. Magnetic properties of various substances, including members of body tissues, are determined by rotation of electrons in their orbits and the inner aspect of their motion (spin). It is this movement of electrons which characterizes a value of a magnetic moment. With respect to MF substances can be divided into diamagnetic and paramagnetic. In diamagnetic substances (some metals - bismuth, silver, and nonmetals - sulfur, carbon, water, most organic compounds, in particular - the carbohydrates and proteins) the magnetic moments of electrons have opposite directions, mutually offset and do not form total magnetic moment of the atom or molecule. Substances belonging to the tissue of a living organism belong to of diamagnetic group. Magnetic permeability of different tissues is close to unity, i.e. almost comparable to that of vacuum. In this regard, as previously thought, an external magnetic field does not exert selective effects on different tissue structures.

With the development of industrial production, science, astronautics and so on people are increasingly exposed to the biological MF action on living organisms.

Accumulated in biological science data strongly supports the use of permanent magnetic fields. Even some authors recommend an alternating magnetic field that controls biological processes.

Magnetism is a universal phenomenon of the world around us which determines living conditions and life itself on Earth. Having mastered the secret of an artificial magnetic field, mankind can now restore the earth's ecological balance.

In March 1820 Danish physicist Oersted discovered a magnetic effect of the electrical current. Then in October of the same year a French physicist Argo used this phenomenon to produce manmade permanent magnets. Since then man have accumulated vast experience of applied use of permanent magnets.
If in Oestered's experiment a magnetic field is defined by a current then in a substance treated with a magnetic device we obtain electric current with the help of magnetic fields of permanent magnets.

Our planet earth is surrounded by an electrical field. It is almost like its surface and its ionosphere act as giant covers of a spherical capacitor, hence life originated in a continuous electrical and therefore magnetic field. Life emerged and continues to develop under its constant exposure.

Theory of Magnetic Systems Processes

When liquid is mobile in a magnetic field, then its charged particles will be affected by a Lorentz force; which is perpendicular to the direction of charged particles and to direction of a magnetic field:

F=q*[v x B],

q- electrical charge
B- vector of magnetic induction
V- vector of speed

Specific speed and magnetic induction initiate a change in a structure of liquid. This is called magnetic-hydro-dynamic resonance.

Therefore using relatively small energy of permanent magnets, it is possible to significantly change structure of liquid - i.e. initiate second-order phase transition.
As a result of this transition (changes structure without altering natural condition of substance) properties of liquid significantly change.

Improves water properties by decreasing.

- Viscosity of 3-4%
- Surface tension by 10-13%

Improves water properties by increasing:

- Electrical conductivity by 7-26%
- Optimal heat capacity by 3-4%
- Latent heat by 10-40%
- Magnetic susceptibility by 200-450%

Magnetic Devices

Specialized magnetic devices can be divided into 2 categories: systems for water magnetization and systems for seed/animal feed magnetization.

Either metal or plastic is used in manufacturing of most systems.

The main difference between different systems/devices is its water capacity/hr and its resilience to harsh environments.

AGI100
Capacity: 2-3m3/hr
Body: Metal
Application: Can be used without preliminary filtration. Brackish water can be used for irrigation.

ADS200
Capacity: 8-12m3/hr
Body: Plastic
Application: Can be used without preliminary filtration. Brackish water can be used for irrigation.

A100S
Capacity: 3-5 m3/hr
Body: Plastic
Application: Can be used without preliminary filtration. Brackish water can be used for irrigation.

AGI200
Capacity: 14-20 m3/hr
Body: Metal
Application: Can be used without preliminary filtration. Brackish water can be used for irrigation.

AGI300D
Capacity: 18-22 m3/hr
Body: Plastic
Application: Can be used without preliminary filtration. Brackish water can be used for irrigation.

A150D
Capacity: 6-10 m3/hr
Body: Plastic
Application: Can be used without preliminary filtration. Brackish water can be used for irrigation.

A200U
Capacity: 20 m3/hr
Body: Plastic
Application: Can be used without preliminary filtration. Brackish water can be used for irrigation.

AGI400D
Capacity: 35-55 m3/hr
Body: Metal
Application: Contains elements for aero ion and electron generation. Can be used without preliminary filtration. Brackish water can be used for irrigation.

AGI300D
Capacity: 20-40 m3/hr
Body: Metal
Application: Contains elements for aero ion and electron generation. Can be used without preliminary filtration. Brackish water can be used for irrigation.

AD600
Capacity: 20-40 m3/hr
Body: Plastic
Weight: 30kg
Application: Contains elements for aero ion and electron generation. Can be used without preliminary filtration. Water with high salinity can be used for irrigation.

AB680
Capacity: 55-90 m3/hr
Body: Plastic
Weight: 30kg
Application: Contains elements for aero ion and electron generation. Can be used without preliminary filtration.Water with high salinity can be used for irrigation.

AD620
Capacity: 80-160 m3/hr
Body: Metal
Weight: 35kg
Application: Contains elements for aero ion and electron generation. Can be used without preliminary filtration. Water with high salinity can be used for irrigation.

AGI800S
Capacity: 90-160 m3/hr
Body: Metal
Weight: 30kg
Application: Removes limescale. Can be used without preliminary filtration. Water with high salinity can be used for irrigation.

A600
Capacity: 70-120 m3/hr
Body: Metal
Weight: 30kg
Application: Contains elements for aero ion and electron generation. Can be used without preliminary filtration. Water with high salinity

can be used for irrigation.

AGI800
Capacity: 130-220 m3/hr
Body: Metal
Application: Removes limescale. Can be used without preliminary filtration. Water with high salinity can be used for irrigation.

A600D
Capacity: 200-230 m3/hr
Body: Plastic
Weight: 13kg
Application: Can be used without preliminary filtration. Brackish water can be used for irrigation.

AGI1000D
Capacity: 200-350 m3/hr
Body: Metal
Weight: 30kg
Application: Removes limescale. Contains elements for aero ion and electron generation. Can be used without preliminary filtration. Water with high salinity can be used for irrigation.

AMS1200
Capacity: 300-500 m3/hr
Body: Metal
Weight: 35kg
Application: Removes limescale. Contains elements for aero ion and electron generation. Can be used without preliminary filtration. Water with high salinity can be used for irrigation.

AGI1400D
Capacity: 400-650 m3/hr
Body: Metal
Application: Removes limescale. Contains elements for aero ion and electron generation. Can be used without preliminary filtration. Water with high salinity can be used for irrigation.

AGI1200D
Capacity: 300-500 m3/hr
Body: Metal
Weight: 30kg
Application: Removes limescale. Contains elements for aero ion and electron generation. Can be used without preliminary filtration. Water with high salinity can be used for irrigation.

AGI1600D
Capacity: 520-780 m3/hr
Body: Metal
Application: Removes limescale. Contains elements for aero ion and electron generation. Can be used without preliminary filtration. Water with high salinity can be used for irrigation.

AMS1200D
Capacity: 300-500 m3/hr
Body: Metal
Weight: 13kg
Application: Removes limescale. Contains elements for aero ion and electron generation. Can be used without preliminary filtration. Water with high salinity can be used for irrigation.

AGI1800D
Capacity: 520-780 m3/hr
Body: Metal
Weight: 30kg
Application: Removes limescale. Contains elements for aero ion and electron generation. Can be used without preliminary filtration. Water with high salinity can be used for irrigation.

A100F
Body: Plastic
Application: Funnel for magnetization of seeds

A600F
Body: Plastic
Application: Funnel for magnetization of seeds

A1000F
Body: Plastic
Application: Funnel for magnetization of seeds

Grain Production
Fruit and Vegetable Farming
Green Houses

Magnetic Treatment in Crop Production

Benefits:

- Decrease in vegetation period.
- Better quality yield.
- Restoration of dry lands.
- Increase in yield.
- Reduction in seed/planting material usage.
- Lower risk of plant disease.
- Less water usage.
- Ability to use brackish water for irrigation.
- Reduction in fertilizer use.

The use of magnetic technology in crop production is completely safe for humans, plants and animals. Not only it is natural, it is also highly beneficial and can increase seed germination, harvest volume and nutrient content of any crops.

The application of magnetic systems for crop production can be divided in 2 phases:

1. **Magnetizing of irrigation water.**
2. **Magnetizing the seed material.**

The following section contains reports of multiple applications of magnetic technologies. It also describes its benefits in crop production and devices used.

Ministry of Agriculture
Russian Federation
Federal State Educational Establishment
Higher Professional Education
Volgograd State Agricultural University

Department of Horticulture, breeding and seed

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APPROVED:
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"_17__" November 2014

REPORT
on scientific - research
"Recognising the effective influence of magnetic water on growth of vegetable crops using intensive technology of cultivation in protected ground"

Head of the research project
Head of the Department of Horticulture, breeding
and Seed, candidate of agricultural Sciences

I.Y. Podkovyrov

Volgograd, 2014

Content

Introduction

Volgograd region is the largest donor region for production of vegetable crops. Areas used for crops can vary slightly from 28.7 to 31.7 thousand hectares, and the volume of production is more than 820 thousand tons per year. In order to increase the efficiency of vegetable growth, optimization of the use of resources of irrigation systems is needed to reduce agricultural costs.

To increase productivity and improve product quality of irrigated areas, adaptation of technologies to the conditions of each area is needed. In this respect, we should consider watering plants using magnetized water, obtained by passing a stream through a constant magnetic field.

By its parameters magnetized water is close to the physiological fluids of plant tissues. Magnetic water is structured water. It is not made up of large and small liquid crystals (clusters) typical to ordinary water, instead it is made of separated individual molecules. As a result, it increases solubility of magnetized water and increases its physiological activity in plant tissues. It also facilitates penetration of water and dissolved in it ions through membranes and cell walls.

The use of magnetic water for irrigation enables to significantly reduce its consumption and increase yields of crops in drought conditions.

Relevance of the topic is related to the need of integration into modernized intensive technologies for vegetable growth of magnetic systems using magnetic water for irrigation. Magnetic technologies were developed in the 70s-80s, when a positive effect of magnetized (structured) water on the growth and development of plants was discovered. With the introduction of new irrigation technologies, resource management, change in irrigation regime, it became a necessity to study the effect of magnetization of water on the growth and yield of vegetables. This is the novelty of the research.

1. Program and method of research

1.1. Research Program

The purpose of this research was to study the effect of magnetic water with different salt concentrations on the growth and productivity of vegetable crops under protected conditions.

The program includes the following research questions:
1. Study of physiological activity of magnetic water on vegetable crops.
2. Identify the effect of magnetic water on quality of seedlings, plant growth and development in protected grounds.
3. Effect of magnetized water on quality and yield of vegetable crops.

1.2. Research Methodology

Objects of research are hybrids of spring onion (Banko) and lettuce (Teremok, Gurman).

Two experiments were carried out in order to determine the effect of magnetic water. First, on seed germination inside petri dishes with magnetized and non-magnetized (ordinary) water. Second, irrigation of plants using magnetized and non-magnetized (ordinary) water.

The following methods were used in research:

In laboratory conditions to determine germination rate (according to GOST R 52171-2003), rate of germination in solutions of different concentrations. The rate of germination is determined in accordance with GOST 24933.0-81. Experiments inside greenhouse were based on methods for vegetable growth developed by B.M. Markov and M.A .Tibrovoy (1956). The experiment carried out in accordance with the requirements of the methodology of experimental work (BA Armor, 1979).

For the experiments inside a greenhouse designed by 'Agrisogaz', two systems were constructed for water magnetization produced by 'Magnetic Technologies' Dubai. Vegetable seeds were initially magnetically treated by passing them through a magnetic field using a special funnel.

The experiment was conducted during the period from 14.08.2014 until 15.11.2014.

Seeds were planted inside containers mounted on racks of a greenhouse. Irrigation is carried out using non-magnetized tap water (control) and magnetized tap water (test). Enriched with peat soils are used as a substrate. Experiments required to replicate high salinity conditions, irrigation solution is prepared using tap water with sea salt and macro-nutrients, needed for plant nutrition. Experiments were carried out in three replicates.

Expected results

1. To show a positive effect of magnetic water on growth, development and productivity of vegetables of different groups.
2. To identify the possibility of using saline water for irrigation of vegetable crops.
3. To identify the positive effect using magnetic water on ground's salt content.

Table 1 Experiment of using magnetized saline water for irrigation

Experiment variables	**Spring Onion 'Banko' variety F1**	**Tomato 'Kalista' variety F1**
Tap water (control)	***	***
Magnetized tap water	***	***
Magnetized water with salt concentration 3 g/l	***	***
Magnetized water with salt concentration 4 g/l	***	***
Magnetized water with salt concentration 5 g/l	***	***
Magnetized water with salt concentration 6 g/l	***	***

*** repetition of experiment**

Funnel for seed magnetization

Seed magnetization

Device for water magnetization

Experimental greenhouse

Figure 1 - Experimental conditions

2. Physiological activity of magnetic water in vegetable crops

The main objective of crop production is adequate water supply, especially in hot dry climates. Knowledge of physiological basis of water regime enables to properly develop correct methods of water supply to plants and to select necessary equipment for management of water supply. Absorption of water by plants occurs at microscopic nano level by different structures of the cell. Water is the most important substance as it is involved in all physiological processes.

Water binds cells and tissues together, it is involved in the sequencing and structure of membrane structures. It acts as a solvent and takes part in many biochemical processes. During photosynthesis, it acts as a donor for electrons and protons, used for restoration of biosynthesis. Its molecules are involved in oxidative processes.

Inside plant tissues, magnetized water can be found in free and bound states. Free water is characterized by high mobility and is free of impurities. Bound water has limited mobility and serves as a solvent. It is bound by osmotic, colloidal and capillary ineractions. The number of bound ions with magnetized water inside the leaves can be quite large, as indicated by the high water retention capacity of leaves.

To determine that, a specific type of lettuce was selected, since its leaves have no specific protective mechanisms on the surface and dry out quickly due to loss of water. Irrigation of plants using magnetized water enables its molecules to easily bond and form chains, preventing its evaporation during stress conditions.

Lettuce varieties (Teremok and Gurman) were irrigated using magnetized and ordinary water. Lettuce leaves were picked in the morning hours in order to determine its water-holding capacity, wilting point and the rate of recovery of rigidity in tissues of plants enriched with ordinary and magnetized water.

Table 2 The effect of magnetic water on indicators of water regime of lettuce leaves

Indicators of water regime in leaves	Magnetized water		Ordinary water	
	'Teremok' variety	'Gurman' variety	'Teremok' variety	'Gurman' variety
Total content of water in leaves, %	83.4	85.1	82.9	85.3
Water retention ability, %	89.7	83.8	80.4	78.15
Turgidity, %	86.6	84.3	74.5	79.2
Water deficit, %	11.5	9.9	13.2	13.6
Speed of recovery of turgidity, min	45	50	75	90

Plants form bonds between moisture in the soil and inside tissues. Lack of water in the soil attributes to wilting of the plant, accompanied by a variety of other physiological disorders. Wilting plants have higher temperatures in leaves, weaker photosynthesis, lower nutrient utilization and delayed growth processes. Even short term wilting has negative consequences to the plant. This is illustrated by the long term effect of a slower growth rate in a wilting plant; even after normal water supply is restored, it takes a long time to reverse this process.

According to the theory of photosynthetic productivity, all processes of plant activity are provided with energy by photosynthesis. Quantitative characteristics of this process depends on a number of factors (environmental temperature, light conditions, etc.). However one of the most important factors is the physiological condition of water in the tissues, as its molecules are involved in providing hydrogen atoms. The initial materials needed for the process of photosynthesis are: 6 molecules of carbon dioxide, 12 molecules of water and 2,826 units of energy (joules). Increase in photosynthetic activity of vegetable crops is considered as an increase in its productivity.

The amount of pure productivity of photosynthesis in lettuce and spring onion was determined using different methods of plant irrigation, i.e. using magnetized water and ordinary water. The average differences between crops of pure product of photosynthesis, were small and accounted to g / day. However, both crops revealed the positive effect of magnetic water on the product of photosynthesis (Table 3).

Table 3 The effect of magnetized water on photosynthesis productivity in vegetable crops

Crop	Increase in dry weight. kg	Leaf area, м²	Efficiency of photosynthesis g of dry substance per 1 m2 of leaf surface per day
Полив омагниченной водой			
Lettuce 'Termok'	0.39	5.32	1.95
Lettuce 'Gurman'	0.41	4.74	2.31
Spring onion 'Banko' F1	0.33	2.81	3.14
Полив обычной водой			
Lettuce 'Termok'	0.30	4.78	1.67
Lettuce 'Gurman'	0.31	3.56	2.32
Spring onion 'Banko' F1	0.26	2.69	2.58

Pure productivity of photosynthesis indicates the quantity of total dry biomass formed by plants during the day per 1 m2 of leaves. Average productivity of leaves for the whole growing season can be determined by dividing the weight of total biological yield by the index of photosynthetic capacity. This value is important in determining yield formation during the growing season and may vary in studied cultures between 1,95-3,14 g / m2 per day.

It should be noted that crops irrigated with magnetized water have higher photosynthetic productivity, due to a more favorable for physiological processes structure of water in the leaves.

3. Influence of magnetic water on germination of vegetable seeds

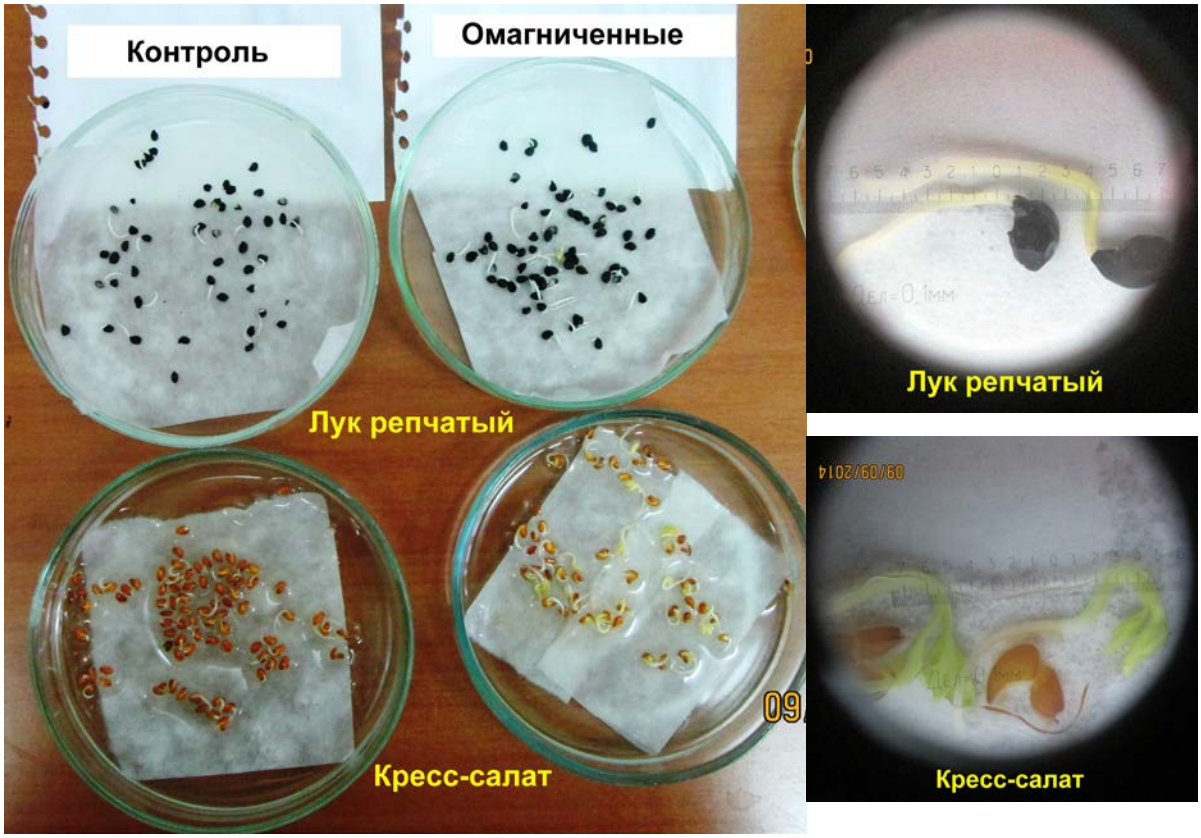
Early stages of ontogenesis in lettuce and spring onion plants are characterized by slower growth rate of vegetative mass and differentiation of organs. Using magnetic treatment has improved quality of seedlings in the experiments. Studies prove that magnetic treatment of seeds and its germination in magnetized water, using experimental magnetic system, has a positive influence on seedling growth (Table 4).

Table 4 The effect of magnetic treatment on the growth of seedlings of onion and watercress

Experiment variables	3rd day after sowing		5th day after sowing	
	Root length, mm	Stem length, mm	Root length, mm	Stem length (leaf), mm
Spring Onion				
Without magnetic treatment	2.2±0.09	-	12.6±0.37	16.8±0.42
With magnetic treatment	4.2±0.11	-	18.2±0.56	17.4±0.39
Excess over control, %	47.6	-	30.8	3.5
Water cress				
Without magnetic treatment	3.5±0.10	2.7±0.09	68.4±0.93	27.8±0.18
With magnetic treatment	5.2±0.13	3.6±0.11	95.8±1.87	33.3±0.21
Excess over control, %	32.7	25.0	28.6	16.5

The best results were observed in the first days of germination, when the root increases in size by 32.7% in watercress and 47.6% in spring onion. With further germination, the effectiveness of magnetic treatment starts to decrease.

Magnetic treatments is most effective when used to improve energy of germination of seeds with a dense shell (e.g. onions). Structured water better penetrates the fetus and activates cell division in embryonic root. As a result, this leads to the appearance equally germinated shoots. Seed germination occurs 1-2 days earlier which is especially important in arid climates (Figure 2).



Seed sprouts in laboratory conditions

Improvement in ground germination of water cress using magnetic treatment of seeds and water

Figure 2 - Seedlings of vegetable crops after magnetic treatment

4. Growth and yield of vegetable crops using irrigation with magnetized water

The study of growth processes in crops influenced by magnetically treated water enables to obtain the necessary data for the development of a system providing mineral nutrition and necessary moisture. Irrigation of plants using magnetic water leads to its increased growth, resulting in larger leaves, stems and aboveground mass (Table 5).

Table 5 The effect of magnetic treatment on growth of vegetable crops

Experiment variables	4-leaf stage		6-leaf stage	
	Length, cm	Mass above ground, g	Length, cm	Mass above ground, g
Spring onion				
Without magnetic treatment	15.6±0.67	0.20±0.01	18.3±0.13	0.41±0.02
With magnetic treatment	17.1±0.72	0.28±0.02	22.2±0.14	0.69±0.03
Excess over control, %	8.7	28.6	17.6	40.6
Lettuce				
Without magnetic treatment	8.2±0.07	1.19±0.03	17.0±0.11	2.8±0.12
With magnetic treatment	9.3±0,08	1.52±0.02	19.6±0.13	4.5±0.63
Excess over control, %	11.8	21.7	13.3	37.8
Tomato				
Without magnetic treatment	9.4±0.73	1.2±0.06	12.1±0.07	2.6±0.09
With magnetic treatment	11.9±1.87	1.7±0.07	16.6±0.09	4.1±0.11
Excess over control, %	21.0	29.4	27.1	36.6

The experiment has shown that under the influence of magnetic water, the intensity of growth processes increases. It also made evident the difference in plant growth between magnetically treated plants and those irrigated using ordinary water. Thus depending on the crop , increases by 13,3-27,1% and increases as the plant ages. Most importantly, magnetized water stimulates growth and development of the root system, which in turn positively affects the growth of the above surface part of the plant and develops strong plants.

Leaf surface area in green crops grows rapidly only in favorable growing conditions with an air temperature of 18-22 C and a high level of mineral nutrition. Lack of macronutrients and low temperatures, cause stress and can greatly reduce the effectiveness of magnetic water. Therefore, the greatest effect is observed using intensive cultivation technologies and high levels of agricultural technologies(Figure 3).

'Teremok' variety **'Gurman' variety**

Figure 3 - lettuce plants grown using magnetic water and ordinary water

As a result of this research, yield of salad from 1m2 was on average 2.1 kg and had the highest yield increase in combinations of irrigation with structured water and sowing magnetically treated seeds by 23.2%

compared to control. The lowest yield was in control plots without magnetic treatment, 1.79 kg / m2 (Table 6).

Table 6 - The yield of green crops using structured water for irrigation

Crop	Урожайность с 1 м², кг		Excess, %
	Irrigation using ordinary water	Irrigation using magnetized water	
Lettuce 'Teremok'	1.79	2.33	23.17
Lettuce 'Gurman'	1.88	2.45	23.26
Spring onion 'Banko' F1	1.54	1.97	21.83

The most responsive to irrigation with magnetized water was a crop variety 'Teremok". This modern variety can use nutrients more effectively during growth. "Gurman' crop variety was less responsive to water improvement method and had a maximum yield increase of 2.45 kg / m2.

Differences in the variants of the experiment were observed mainly during maturation stage of lettuce. In the initial stages of ontogenesis, lettuce had similar values of morphological parameters. At germination stage, plants feed on complex storage of embryonic substances and its consumption from ground is minimal. In phase 2-3 of fully grown leaves , the need for mineral elements is insignificant. Increase in size of lettuce plants as a result of using magnetic treatment had resulted in earlier maturation of products (Figure 4). "Teremok' crop variety was harvested 7 days earlier than control. Whereas 'Gurman' crop variety was harvested 5 days earlier. Also it was noted that lettuce growth rate is faster during autumn period. This is due to a more favorable thermal conditions in the protected ground.

Figure 4 – Experimented on lettuce leaves of 'Gurman' crop variety

Similar patterns are observed in the spring onions. On the basis of conducted experiments it can be concluded that structured water positively influences the development of lettuce and spring onions.

5. Growth of crops using magnetized water with high salt content for irrigation

Higher salt content of irrigation water and ground has a toxic effect on plants, resulting in poor growth and lower yield. Domestic and international experience using structured water for irrigation with high salt content show positive results in fruit growing and in growing crops for animal feed. In a protected ground on artificial substrates such studies to date have not been conducted. Thus making this experiment somewhat more interesting.

Irrigation of spring onion and tomatoes planted on peat soils, using saline solutions of 3 to 6 g / l, enabled to determine optimal salt concentrations for the tested cultures. The increase of the above ground mass of tomato and spring onion, under the influence of salts, was slower compared to control. Saline solutions made using magnetized

water had less toxic effect and did not inhibit plant growth as much(Figure 5, 6).

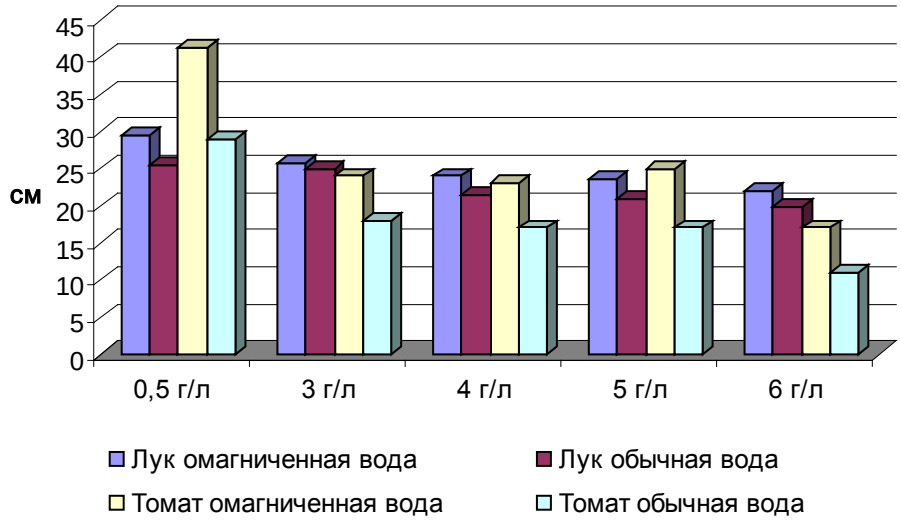


Figure 5 - The height of test tomato and spring onion plants at various salt concentrations of the irrigation water

IT was observed that spring onion was less responsive to the salt content of irrigation water, compared to tomato plant. Water structured using magnetic field, increases salt tolerance of a crop, but reduces plants' overall productivity by around 12,5-25,1%. Significant growth inhibition occurs at a concentration of salt of more than 6 g / l. Acceptable salinity of irrigation water, provided it is magnetized, must not exceed 5 g / l when growing tomatoes and spring onions.

Figure 6 – Spring onion plant after irrigation with salty water

Conclusion and suggestions

1. Magnetic devices for water and seeds treatment, made by 'Magnetic Technologies LLC' Dubai, can be recommended for a wide range of use in agriculture as it proves to be highly effective in increase of crop yield.
2. Magnetized water has a high physiological activity, resulting in an increase in pure photosynthetic productivity of plants and improvement of water regime in leaves. This reduces the effects of stress from drought and lack of light in extreme conditions of growing vegetables without significantly reducing productivity. It can be recommended to irrigate plants using magnetized water in drought conditions in order to increase water retention of leaves and to support its biological activities.
3. Magnetic treatment of seeds prior to sowing followed by irrigation using magnetized water, increases germination rate, improves quality of seedlings and reduces germination time by 1-2 days. These methods accelerate the development of plants in the early stages, which reduces the time needed to obtain yield by 7-10 days.

It is recommended to soak vegetable seeds before sowing in magnetized water for 10-12 hours to activate its germination.

4. The use of water, structured by using magnetic field, during vegetation and yield formation stages of green crops (lettuce, spring onion) leads to an increase in yield at protected conditions when grown on peat soil by around 21.8-23.2%. Also timely execution of complex agricultural activities (feed, irrigation, etc) also has a positive effect.
5. Irrigation water with high salt content is recommended to undergo a magnetic treatment using devices made by 'Magnetic Technologies' Dubai, to reduce its toxic effect on vegetable crops. Total crop productivity using saline water for irrigation is reduced by 12.5-25.1%, however magnetic treatment of water enables to increase productivity of crops by 3.1-11.4%.
6. In protected ground, it is recommended to use irrigation water containing toxic salts not to exceed a concentration of 5 g / l and to use magnetic devices during irrigation.
7. It is not recommended to irrigate soil and sprouts using water with salt content (more than 3 g / l) as it leads to the death of seedlings. Use of saline water is possible during growth and ripening stages, when the adaptive capacity of plants is higher compared to seedling stage.

Literature

1. Aliyev EA Smirnov NA "The technology of cultivation of vegetables and mushrooms in a protected ground." - M .: Agropromizdat, 1987.
4. Andreev, VM Workshop on Vegetable: Proc. aid for students Woo-call of specialization "Agriculture" / B. M. Andreev, VM Markov.- 2nd ed., Rev. and ext. - M .: VO "Agropromizdat", 1991. - 207 p.
5. Andreev, VM Intensification of production of early vegetables in the Lower Volga Region In /V.M. Andreev.- Volgograd: VSHI, 1993. 50 p.
3. Antonov, AV Irrigated horticulture /A.V Antonov, GE Berezkina, SA Angelica. - Kiev: "Harvest", 1990.- 472 p.
2. Autko AA Vegetable protected ground / AA Autko, GI Hanus, NN Dolbik. - Minsk: VEVER, 2006. -320.
3. Vashenko SF, Chekunova ZI, Savinova NI et al., "Protective Vegetable-schennogo ground." - M .: Kolos, 1984.
4. Gish RA Vegetable southern Russia: the textbook / RA Gish, GS Gikalo. - Krasnodar: Edwy, 2012.-632.
5. Zhurbitskaya ZI Theory and practice of growing method. - M .: Nauka, 1968. - S. 46 - 84.

6. Circle G. Vegetable / T. Krug. M .: Kolos.-2000.-572s.
7. Litvinov SS Scientific foundations of modern vegetable production / SS Lithuania-new. -M .: RSHA, 2008.-776s.
8. Guidelines for the field experiments with vegetable crops. Volgograd, 1995.-42.
9. Mikaelian GA Fundamentals of optimal design of production processes in vegetable / GA Mikaelian, RD Nurmetov. - M .: ROSINFORM-groteh, 2005.-640c.
10. Field VV Workshop on the growth and sustainability of plant / V. In the left [et al.]. - L., 2001. - 212 p.
11. Resource-saving technologies of vegetable cooking peat soils / A.A.Autko [et al.] // Natural resursy.- 2005.- N2.- S. 37-42.
12. Sergienko LI Agro-economic monitoring in the water - soil - plant - fertilizer as a means of greening agriculture Zavol-Region, .// Conference on regional scientific and technical program "Scientific, technical and environmental problems of the Volga" Volga, 1997. 70-72 seconds.
13. Handbook for Vegetable. / Comp. VA Bryzgalov. -M .: Kolos, 1982. - 512 p.
14. Yurina AV Mamonova LG, LA Kardashina and others. "greenhouse vegetables-duction." - Sverdlovsk Sred.-Ural. KH. Publishing house, 1989.

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"_17__" November 2014

Protocol of experiments No. 6 from 17.10.2014
Name of Institution: Biotechnological laboratory of agriculture, department of horticulture, breeding and seeds, Volgograd

Address: 400002, Volgograd, Universitetskii, 26
Name of equipment: device for watering plants with magnetized water.
Commissioner: Magnetic Technologies LLC, Dubai
Experiment date: from 14.08.2014 to 15.11.2014
Results of experiments: Experiments using a device for watering plants with magnetized water were carried out on lettuce, water cress, tomato and spring onion plants, inside 'Agrisogas' greenhouse.

Proven that magnetization of seeds and its germination inside magnetized water, derived using mentioned above device, has a positive effect on growth of seedlings (Table 1).

Table 1 The effect of magnetic treatment on growth of seedlings of spring onion and water cress

Experiment variables	3 days after sowing		5 days after sowing	
	Root length, mm	Stem length, mm	Root length, mm	Stem length (leaf), mm
Spring onion				
Without magnetic treatment	2.2±0.09	-	12.6±0.37	16.8±0.42
With magnetic treatment	4.2±0.11	-	18.2±0.56	17.4±0.39
Excess over control, %	47.6	-	30.8	3.5
Water cress				
Without magnetic treatment	3.5±0.10	2.7±0.09	68.4±0.93	27.8±0.18
With magnetic treatment	5.2±0.13	3.6±0.11	95.8±1.87	33.3±0.21
Excess over control, %	32.7	25.0	28.6	16.5

The best result was observed within the first days of germination, when a root increases in size by more than 32.7% in water cress and 47.6% in spring onion.

Irrigation of plants using magnetized water leads to its increased growth, which is reflected in the increase of leaf size, stem and above ground mass (Table 2).

Table 2 The effect of magnetic treatment on growth of vegetable crops

Experiment variables	4-leaf stage		6-leaf stage	
	Length, cm	Mass above ground, g	Length, cm	Length, cm
Spring onion				
Without magnetic treatment	15.6±0.67	0.20±0.01	18.3±0.13	0.41±0.02
With magnetic treatment	17.1±0.72	0.28±0.02	22.2±0.14	0.69±0.03
Excess over control, %	8.7	28.6	17.6	40.6
Lettuce				
Without magnetic treatment	8.2±0.07	1.19±0.03	17.0±0.11	2.8±0.12
With magnetic treatment	9.3±0,08	1.52±0.02	19.6±0.13	4.5±0.63
Excess over control, %	11.8	21.7	13.3	37.8
Tomato				
Without magnetic treatment	9.4±0.73	1.2±0.06	12.1±0.07	2.6±0.09
With magnetic treatment	11.9±1.87	1.7±0.07	16.6±0.09	4.1±0.11
Excess over control, %	21.0	29.4	27.1	36.6

A difference in plant growth is observed among plants irrigated using ordinary and magnetized water. Depending on the crop it can vary by 13,3-27,1% and increases as the plant ages.

A device for irrigation of plants with magnetized water can be recommended for a wide range of use in agriculture as it proves to be highly effective during experiments.

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