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APPLICATION OF BIOPHYSICS METHODS IN CROP PRODUCTION AND PLANT PROTECTION

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SUMMARY

The plants have perfect and various synthetic possibilities. These possibilities led to development of complex organic matters, full of energy, from the simple inorganic organisms. That is why the plants have distinctive and specific place among the life forms on our planet. Generally they are highly organized and dynamic organisms, who are moving and transforming the organic mater in their potential chemical energy.

Today it is well known that photosynthesis at plants is a unique bioenergetic mechanism, which uses sun energy. The plants transform that energy for their purposes and their life processes, which energy in later stages as food is used by humans and the rest of the life organisms on Earth.

But the green plots on Earth are using about 0,3 % of the sunlight. The plants at optimum conditions are capable to absorb from 5 up to 10 %, although some research results show that the percentage is up to 20 %. That points to the facts that mankind has enormous reserves of energy for solving its own energy problems, and Republic of Macedonia Republic of Macedonia it's all free for use.

Key words: UV – rays and gamma rays, ultrasound and ionized radiation, bioengineering

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ПРИМЕНА НА БИОФИЗИЧКИ МЕТОДИ ВО РАСТИТЕЛНОТО ПРОИЗВОДСТВО И ЗАШТИТАТА НА РАСТЕНИЈАТА

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КРАТОК ИЗВАДОК

Растенијата имаат исклучителни синтетски можности. Тие од неорганските материи создаваат комплекс на органски соединенија, полни со енергија. Заради овие способности тие заземаат специфично место меѓу сите живи организми на Земјата. Генерално тие се високо организирани и динамички организми кои ги транспортираат и трансформираат органските материи во потенцијална хемиска енергија.

Денес, добро е познато дека фотосинтезата на растенијата е единствениот механизам кој ја користи сончевата енергија за сопствени цели, но, таа подоцна, како храна се користи од страна останатиот жив свет на Земјата. Бидејќи зелените растенија, сончевата светлина ја искористуваат само околу 0,3 %, останува отворено прашањето од недостигот на енергија за решавање на човековите потреби.

Затоа, научниците за XXI век ја насочуваат науката и практиката кон истражувања и примена на методи за зголемување на способноста на растенијата за искористување на сончевата светлина, како и употреба на дополнителни извори на енергија, кои ќе овозможат зголемување на физиолошките, хемиските и ферментативните процеси во растенијата. Со тоа се има за цел да се оспособат растенијата да ја организираат својата вегетација на повисоко енергетско ниво, што ќе допринесе за формирање поголемо количество корисни метаболити. Исто така, според резултатите на голем број истражувачи непобитни се позитивните

ефекти на биофизичките методи врз производството на здравствено безбедна храна и заштитата на животната средина. Во овој труд ќе биде прикажан дел, од досега истражуваните биофизички методи во растителното производство и нивното влијание врз полделското производство и животната средина.

Клучни зборови: UV – зраци, гамма зраци, ултразвук и јонизиращка радијација, биоинжинеринџ

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PRODUCTIVITY OF PLANTS

The productivity of plants is result of integration of many basic processes: photosynthesis, breathing, and transportation of metabolites, growth and development and hormone-inhibitor state.

The results of scientific research, confirm the importance of primary and secondary photosynthetic processes, which depends of photochemical and fermentative phases. Activity or intensity of function of different components and their management has essential meaning on yielding capacity.

EFFECTS OF LIGHT

The sunlight is the essence for the crop production and for life on the Earth also. The photons, very small components of light, full of energy, are causing the photochemical reactions. A photochemical reaction is possible if the absorbed quant of energy is bigger than the energy threshold of the cell. That is why the contemporary biophysicists are studying photo biological processes and the influence of the light on the biological systems. Special attention is consecrated on influence between quant of light and biological structures: macromolecules, membranes, cell and tissues. It is known that the chlorophyll absorbs the light and trough the corresponding mechanisms transform it into biological matters on molecular level. In biophysics foundation of biological substance is deduced on atom level.

The light radiation has determpied characteristics: wavelength, changeable electromagnetic movement and energy of photons (light's quant).

The absorbed light quant from the cell structures defiant the photosynthesis and phototropic processes.

The great Russian physiologist K. A. T i m i r j a z e v excellence right formulate the role of light *"Sometime, somewhere the sun beam fell on the earth surface and it landed on the young green wheat plant, better said, on the chlorophyll kernel. Touching it, the sunbeam cease to be light, but it didn't disappear... The sunbeam in the same or another form entered in the structure of bread, which nourish us. It is transformed into ours muscles, ours nerves.*

Right now the atoms of carbon into our organism are building new products with oxygen, and the blood transports them into every part of our body. At the same time the sunbeam transform itself into new chemical products and energy. That's sun beam now warms us. It's gives us ability to move, maybe in this moment it is playing in our brain"

TRANSFORMATION OF LIGHT

The first step of light transformation into the plants is excitement and transmission of electrons. The hypothesis of transformation of the light going on next scheme:

- Light absorption by the chlorophyll complex;
- Excitement of electrons or electrical pumping of protein chain;
- Izomerazation of chlorophyll molecules and complexes;
- Chemical processes (in the dark) reaction or serial chemical processes;
- Biochemical processes: enzyme activation, synthesis of ATP, ions transportation etc;
- ∴- Using the ATP at physiological processes and;
- Restabilization of final position (isomerization or synthesis)

For understanding the process and the ecological role of interaction influence between electromagnetic field and life organisms, it is necessary to understand contemporary knowledge of mechanisms of interrelation between electromagnetic fields and structure of cell membrane.

Membranes coordinate many metabolic processes: enzyme activities, changes in chemical processes, transmission of matters and information's. Membranes of chloroplasts at green plants and mitochondria's practice the energy transformation. First phase of transformation of energy is from light into electrical energy ("physics"), in the second phase this energy is transformed into the energy of chemical connections - ATP ("photochemical"), and in the third phase in the synthesis of organic matters ("fermentative").

The photosynthesis and breathing present two sides of the same process of electricity transport, which is the basis of the bioenergetics.

THE ENERGY OF ATP

All metabolic processes are result of obvious transformation of any energy into electrical. It means that the plants manage their physiological processes with same perfect kind of energy - electricity.

Based on results of the method for registration of plants biopotential it was discovered that the plants by bioelectrical polarization and electric excitation of their cells are able to exchange free electrons inside the plant, as well as outside the plant, into the environment.

Dielectrics are created by the different outside influence on lived organisms:

- Temperature (thermoelectric);

- Light (photoelectric);
- Electric fields - different radiation (radio electric);
- Magnetic fields - (magnetic electric);
- Mechanical deformation (mechanic electric).

Bioelectric are formed, by spontaneous polarization of dipole complexes by delivered energy of physiological processes (breathing).

Because every organism has own electrical system, with specific characteristics and dynamics, science results, point to possibilities for management of life processes with outside electrical intervention.

That is why the future research work ought to be in direction for application of the electrical fields on biological mediums for straightening the physiological processes and their influence on environment to create optimize living conditions.

PHOTOBIOLOGY PROCESSES

Photobiology processes are very different, composed of many phases, from the beginning of light absorption to the end of physiological processes on all plant's levels. The physiological processes conditionally are divided on:

- Light absorption;
- Photophysics processes and inter molecular exchange of energy;
- Intermolecular processes for transport of energy at exciting situation;
- Starting photochemical reaction;
- Dark phase - final reaction for constitution of stable products;
- Biochemical reaction with participation of photoproducts, and;
- General response on light influence.

First three stadiums of photo biological process are included in the photochemistry and luminescence processes, influenced by the light wavelength. Influenced by the electrical excitement, the double structure connections are changed, the process of polarization is started, molecule's pH value is changed and the elections receiving/ emitting characteristic is altered.

AGRICULTURAL PRODUCTION BY CONVENTIONAL METHODS

The agricultural production, with conventional measurements (soil cultivation, fertilizing, melioration, irrigation, protection of plants etc), is increasing the consumption of energy per unit of product, about ten times more. Because of that,

today, the price per calorie from industrial food products is very high. That way in the word, the scientists elaborate the methods and materials for increasing of the yielding capacity of cultivated plants, but in the same time to lower the input of energy for the primary production and technology of food.

Sustainable agriculture has different meanings for different people. For some of them it means continuing present farming methods, for others it demands new efforts in research, development and implementation on ecological integrity. Summarizing all means of sustainable agriculture, it is management system for renewable natural resource for food production, income and livelihood for present and future generation, maintaining and improving the economic productivity and ecosystem.

Sustainable agriculture is a function of many factors including a concept of stewardship. The goal of the sustainable agriculture is to utilize the fertilizers, chemicals, manure efficiency trough the use of soil testing, innovate crop management technique, integrated pest management, usage the natural growing regulators and biostimulators, controlling the water and air pollution.

For effective implementation and operationalization of the sustainable agriculture in each country is necessary to be institutionalized and long-term financial support.

In the last 50 years the chemical technology made scientific and production revolution in agriculture. Many chemicals are used for fertilizing crops, control of pests and helped in development of highly successful farm systems, all that to ensure an abundant and wholesome food supply. But sometimes the impact on the environment and public health was huge. The long-term usage of chemicals in food production, whose compounds are causing decreasment bouth of plant resistance and the soil bioenergy structure, results in decreased yielding capacity.

NEW METHODS AT THE AGRICULTURAL PRODUCTION

Human success in crop production is appraised trough the capability and knowledge for harmonization of plant needs and soil and climatic conditions potential for every plot and region, resulting in higher and stable production.

Today in comparison to the beginning of the last century, for production of one unit agricultural product, ten times more energy is spending than before. That's way many agricultural experts look for possibilities for more efficient and effective usage of energy by the plants.

For intensification of crop production on the today level of agriculture science and practice development, is necessary to mobilize a new sources for increasing of yield capacity of crops. Parallel with improving the ordinary agro technical measurements and involving the new ones.

The scientist are foreseeing the future of food production and protection of environment in the following directions:

- *Creation of the new varieties by classic methods of genetic and breeding;*
- *Creation of the new varieties trough biotechnology methods – bioengineering, and*
- *Searching of the additional bioenergy sources and biostimulators.*

In that way biophysics methods are useful for plants capable to vegetate on higher energy level. Based on the fact, that physics methods increase the energy amount by internal transformation of energy, independently of their origin, into electrical and increasing the electro potential of the membrane. Biophysical stimulation on the seed and plant, trough increasing the energy balance and intensification of material exchange, are accelerating the growth and yielding processes.

From that point of view many worlds' scientists think that this century will be "century of biophysics application". Biophysics is a part of science dealing with biophysical and energy-information processes in living beings.

The basic characteristics of dielectrics advising from the possibility of polarization, in other words from the possibility to cross into the electrised position under the physics, chemicals or mechanical influence.

Maybe at this time many responses about mechanism of the influence are unknown, but this problem is extremely complex and need interdisciplinary engaged research. Pollution of the environment, risk assessment and stagnation technical and technological development without using the unionizing radiation is very hard to solve. But biology systems are extremely sensitive on different radiation and the research and those applications are very responsible work.

Innyushin, 1990, wrote that today's science survival across to "cosmic" evaluation on all processes on our planet, and that's is necessary to discover relations between forces and material, connecting and elaborating the astrophysics and astrochemical phenomena's together with biophysics and biochemical processes of the forces of cosmobiology.

POSSIBILITIES OF APPLICATION THE NEW METHODS IN AGRICULTURE

Many results from scientific research on seed or plant radiation with UV - rays and gamma rays, ultrasound and ionized radiation show determined effects on growth and development of the plants. But a problem occurred in the application of the radiation treatment that is the unstable reaccurance of the results at each treatment.

The treatment on life organisms by laser light shows reiterating positive effects. From results achieved in another countries and ours twenty years investigation the agronomy practice can be encouraged for wildly application. Depends of the mediums for treatment, cultivars, varieties or animals are reached different results, but in every case they affirmative it's application.

He-Ne lasers, emitting red coherent light with wavelength of 630-650 nm, are used in agriculture, forestry, and food technologies. It's possible to treat seed, seedlings, plants and field, with these lasers, as is irrigation water, also.

Dielectric separation and stimulation of seed can be done with separately equipment (dielectric separators) by special electricity powered inductors, which produce magnetic fields. That electromagnetic field is pulling the seed on the end of inductors, where they are kept and stimulated.

Trough the method of resonant impulse, electromagnetic stimulation is afflicted on seed and plants. The stimulation is done by various frequencies for different cultivars.

The method of the effect of "goldenkrossing" on electromagnetic fields, based on the Keops Pyramid principle, gives opportunities for stimulation of seed and seedlings. As the treated materials varied so did the results, but every time in positive direction.

TYPES OF RADIATION

There are three types of radiation based on its origin:

- *Atmosphere radiation* (cosmic 90% protons and 10 % beta rays)
- *Earth radiation* (from the nature radioactive elements of stones, and salts which contain: uranium (U 218), radium (Ra 226), thorium (Th 232), radon (Rn 222), produced after disintegration of uranium. In the soil is possible to find radioactive potassium (K 40) and carbon (C 14).

- *Artificial sources (man made sources)*

Based on the physical characteristics radiation is divided in two groups:

- *Ionized*
- *Nonionized*

IONISED RADIATION

- *Natural - cosmically (protons, neutrons, electronic, X - rays, and alpha, beta and gamma rays.*
- *Radiation from man made sources*

NONIONISED RADIATION

- *Ultraviolet radiation*
- *Visible light*
- *Infrared radiation*
- *Laser light radiation*
- *Electromagnetic fields*

This radiation presents electromagnetic spectrum with different frequency, wavelength, and energy of photons, independently of its source.

We use radiation in different aims, but in the same time we also research the negative effects on our health.

Nonionized radiation cause different biological effects depending on many factors:

- *Sources of radiation*
- *Modality of exposition*
- *Biological characteristics*

From the viewpoint of human protection from biological effects of nonionized radiation's, electrostatic and magnetic fields and mechanical ultrasounds, wavelengths are included in this group.

Ionized radiation, in physical sence, presents leak of particles or quants of energy ionizing the environment they pass through. The transmission of energy is on microscopic level, that is why significant acceptors are macromolecules (molecules of DNA and proteins).

Many scientific research results, conducted by different ionized or nonionic radiation show some positive or negative effects at growth and developments of plants.

Some of them cause mutagen effects, which scientists use for creation of the new variety with new quantitative and qualitative characteristics.

The radioactive radiation on live organisms influence trough a two stages:

1. *Stage of absorption* - by a few molecules and the modifications microscopically is not visible.
2. *Stage of radiochemical reactions* - influence the visible damage.

Radiofrequency radiation is possible to be reflected on another biological medium, absorbed and penetrate into the depth layers. The absorbed energy can provoke direct and/or secondary biological or biochemical exchanges.

CHARACTERISTICS OF ELECTROMAGNETIC RADIATIONS

The main characteristics of electromagnetic radiations are following:

- *Frequency*
- *Wavelength*
- *Disposition*

All of them have different influence on the plants and mediums.

Presman, 1971 lists tree types of electromagnetic effect on nature:

1. *The influence of electromagnetic irradiation on being processes of organisms*
2. *Electromagnetic influence into the organisms*
3. *Interactive electromagnetic effects between organisms*

Magnetic fields are interacting with the biological systems that are containing ferromagnetic maters. The influence of the magnetic fields, on atomic and molecular level, provokes stimulation of growth, cell differentiation, exchanging of ions and synthetization of DNA, RNA and proteins.

But it is obligatory, to determine the magnetic influence on all life forms on Earth, aiming to use positive and decrease the negative effects.

The research of physics and energy processes on life organisms are working on new methods for seed, plant and animal biophysics stimulation. The essence of stimulation influence of physics factors is to increase the energy level of live organisms, intensification of exchange of maters and activation of processes of growth and development. Exploring the possibilities of repetition of the results anytime, anywhere, is the main task of the scientists. Only if we are headet in that direction we'll be able to reestablish the intercommunication between human been, plants and animals.

Establishing and practical applying of the biophysics methods in plant production will make possible to increase the plant productivity, the quality of products and in the same time to protect the environment.

Achieved results from these previous investigations show managing possibilities of physiological processes on: seeds, vegetative multiply organs and fruits.

SOME BIOPHYSICS METHODS, WHICH CAN BE USED IN PLANT PRODUCTION

At this time we will mention some of them:

1. *Temperature;*
2. *Radiation of live organisms with ultraviolet (UV-rays), gamma rays, ultrasound, ionized radiation etc.;*
3. *Radiation with laser light;*
4. *Dialectical separation and stimulation of seed – DSS;*
5. *Resonance impulse electromagnetic stimulation of seed and plants - RIES – SP;*
6. *Magnetic stimulation;*
7. *Electromagnetic stimulation;*
8. *Application of effect of “golden crossing” of electromagnetic fields and Principe of “Keops Pyramid”;*
9. *Weed control with high electro frequency;*
10. *Electron treatment.*

EFFECTS IN AGRICULTURE WITH BIOPHYSICS METHODS

In agriculture especially in crop production, according to the results of *Inny usin*, 1981, *Alahmad*, 1989, *Vasilevski*, 1987, *Vasilevski at. al.*, 1987, 1988, 1990, 1990, 1994, 1994, 1996, 2000, 2001 the next results is possible to be achieved:

- *Increased seed germination from 20 to 35 %*
- *Decreased seed rates up to 30 %*
- *Increased root masse up 24 %*
- *Increased vegetative masse from 10 to 45 %*
- *Increased yield from 10 to 50 %*
- *Increased resistance on outside influence (drought, frost etc)*

- *Better qualitative characteristics of products (protein, sugar, vitamins and another useful metabolites)*
- *Decreasing mineral fertilizers from 10 to 15 %*
- *Acceleration of the ripening*
- *Receive safety products with higher quality*
- *Decreasing pollution of underground and surface water*
- *Low price of their application*
- *Repetition of the results on various soil and climatic conditions on every cultivars*
- *Decreasing of producer price of products*
- *Increasing the income at producers*

It is very significant to mention that biophysical a method for stimulation doesn't change physiologic processes direction, which is controlled by genetic systems. That's why the optimal dose of seed and plants at application don't initiate genetic effects.

EFFECTS OF BIOPHYSICS METHODS IN ENVIRONMENT PROTECTION

According to the opinion of particular group of scientists, every generation has its own crises. Unfortunately our generation has many: energy deficit, nuclear power and the worst one, the ecological crises. If we did not find an answer to these problems we are headed for an apocalyptical destruction.

From that aspect, protection of environment doesn't know for limitations, economical and/or political problems, sex and age, the attention ought to be shared by all of us, because everyone will feel the consequences.

Seed and seedlings stimulation by biophysics methods is increasing the ability of plants faster growth and resistance on outside influences, resulting in cultivars increased yield and decreased human intervention on crop production by various measurements that effect the environment.

The presented effects in protection of environment are:

- *Better survivals abilities of the plant* - better adaptability and spreading of cultivars, the soil is long time covered by plants and less activity of destructive processes
- *Application of less quantity of mineral fertilizers* - protect the soil, water and plant production
- *Reduce soil cultivation* - better their protection
- *Less application of the pesticides* - less pollution of soil, protons, underground and accumulated water

- *Less cultivation operations on soil* - less wasting the petrol dervates and less pollution the ear.

These methods are applicable for treatment (cleaning) of waste materials from the livestock farm.

Laser light shows possibilities for rehabilitation of water. After treatment free oxygen is increased many times as oxidative processes also. Cleaning of water is more effective and cheaper.

ORIENTATION OF FUTURE RESEARCH INVESTIGATIONS

Research investigations ought to be oriented in the next points:

- Electronic treatment of seed;
- Electronic treatment of plants;
- Cleaning and separating the seed;
- Stimulation of determined physiological processes;
- Inhibitory of same physiological processes;
- Control of plant development;
- Application the electromagnetic fields in food technology;
- Electronic technologies for soil cultivation;
- Holding up the soil salynization;
- Control the pest and diseases;
- Cleaning the water for irrigation;
- Control the pollutions of soil, water and air;
- Protect the globe from the Ozone holes in the atmosphere.

Everything should be oriented for creating the ideal conditions for production of organic matters.

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