

Use of natural electromagnetic phenomena for increase of yield of crops

Chernovol M.¹, Sviren M.², Amosov V.³

Central-Ukrainian national engineering university, Universytetskyi avenue, 8, Kropyvnytskyi, 25030, Ukraine; e-mail: ¹ rektor@kntu.kr.ua, ² kaf_sgm_kntu@ukr.net, ³ v_vas_a@ukr.net

The purpose. To detect influence of electromagnetic field of the Earth on productivity of crops. **Methods.** Field experiment. Methods of mathematical statistics. **Results.** It is determined that between soil and root of a plant, and also an aerosphere there is a continuous process of power interchange. At the first stage of researches ferromagnetic steel wires with the diameter of 2,5 mm were put on the bottom of the agricultural tile at the distance of 12 m. Under the influence of electromagnetic field of the Earth locked loop is created between them through wet soil with direct current in density of 4-6 $\mu\text{A}/\text{cm}^2$. The current supports processes of electrophoresis and electrolysis in the fertile layer. Due to that all chemicals necessary for the plants are transmitted from hardly assimilable into easily assimilable forms. On the experimental areas the yield of grain crops increased from 3 to 8 centners per hectare as compared to the test areas (moldboard and sub-surface cultivation). For measurement of agroelectrical force special device Agro-01 was developed. It enabled to evaluate quantitatively power nature of soil and sowings. They also elaborated technique of monitoring bioplants in field technological environment. During 4 years on fields of "Satori-S Ltd." (Kirovograd oblast) on the area of 3000 hectares overlapping of subsurface cultivation of soil with simultaneous slitting on depth of 40 cm at sowing wheat, corn, soya bean has been carried out. Experimentally positive effect of intelligent use of energy of electromagnetic field of the Earth on productivity of crops is confirmed. New agrotechnical methods of soil cultivation and the developed end-effectors for their implementation are offered. **Conclusions.** As a result of implementation of slitting technique on depth of 40 cm in direction of North-South productivity of crops has increased on 12 – 15%.

Key words: energy of electromagnetic field of the Earth, slit-cutter, power monitoring of soil.

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Problem statement. Living organisms are constantly influenced by electromagnetic, gravitational and other fields. Depending on its nature, duration and intensity the influence may have positive as well as negative impact on the development of plants and other living creatures. Various electrochemical processes that occur under the influence of the electromagnetic field of natural origin in the biological object 'soil-plant' are important for the plant nutrition and metabolism between soil and plants.

Analysis of research and publications. The research of the influence of electromagnetic fields on biological objects were carried out by a number of Ukrainian and foreign scholars.

In his doctoral dissertation Cherenkov O.D. [2] develops theoretical foundations of resource-saving electrotechnologies of the influence of low-energy electromagnetic fields on biological objects and applies the findings in the electrotechnological processes of agricultural production for pre-seeding processing of seeds, animal treatment, control of the dynamics of harmful insects' population.

The objective of the doctoral dissertation of N.G. Kosulina [3] is to obtain biophysical express information for the assessment of the action of the electromagnetic fields on the life activity of the bioobjects on the basis of gas-discharge visualization.

A microprocessor device was developed for express diagnostics of soil condition [4].

The inhibition of weeds by constant electric current of low voltage was also suggested [5].

As an active factor for stimulation of soil or the biological object 'soil-plant' all the researchers accepted the electromagnetic energy of anthropogenic origin.

The objective of the research is to identify the influence of the Earth's electromagnetic field (EEF) on the productivity of agricultural crops.

Research methods. Field experiment. Processing of the results was carried out by the methods of mathematical statistics.

Research results and their discussion. The system of agricultural production is considered to be a living organism with a whole range of important agro-physical and agro-biological processes and agro-electro-chemical reactions. These processes take place at the molecular as well as at the cellular levels under the influence of the EEF. Our research is aimed at identifying the results of this action in the form of electrical phenomena.

Soil moisture can be considered as a natural electrolyte of a natural galvanic bath. The bath is an agricultural field which is continuously influenced of the EEF energy [9].

While considering various phenomena in the electromagnetic field it is assumed that the magnetic field lines of the electric field are perpendicular to the lines of force of the magnetic field: $\vec{E} \perp \vec{H}$. If the charged particle of the substance is in such a field (for example, in the soil solution influenced by the force of the EEF), then the particle drifts in the direction perpendicular to the lines of force of both fields (Fig. 1).

The velocity of the particle drift is determined by the formula [10]:

$$V_{ap} = \sqrt{\frac{cE}{B}}, \quad (1)$$

where E is the EEF intensity;

B is the EEF magnetic induction;

c is the velocity of electromagnetic wave.

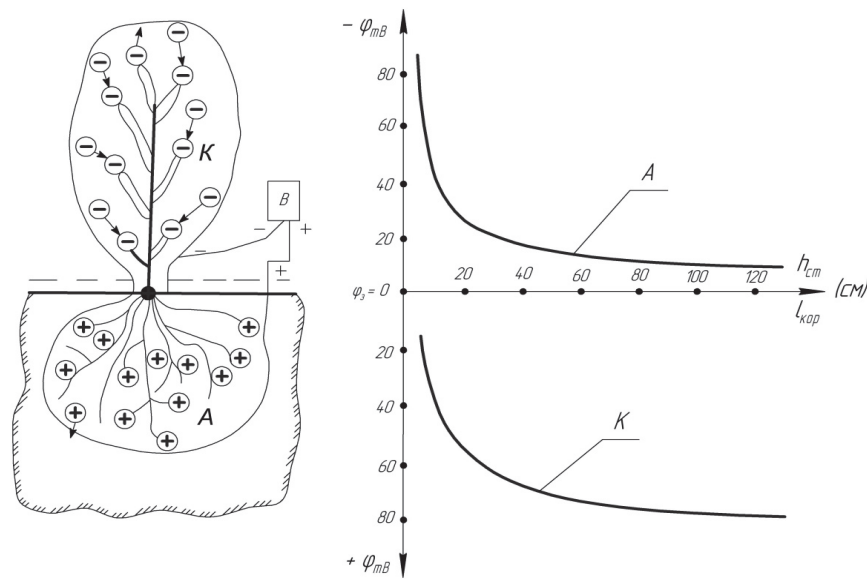


Fig. 1. The nature of the distribution of electric potentials in the biological object 'soil-plant': K is a cathode zone; A is an anode zone.

Therefore, the drift direction of the charged particles of soil moisture can explain the appearance of dual charged layers.

The presence of the dual charged layers on the interface of the division of the atmosphere and the film surface (funicular water) of a natural reservoir or soil moisture and the anode-cathode zones create a difference of the electric potential ($\Delta\varphi$) of natural origin, causes the circulation of the electric current I_n . This is an example of renewable sources of electric energy of the direct current in nature. Influenced by this energy the ions-anions and cations move to the roots of plants; the process of electrochemical transformation of substances in soils and plants is also activated (Fig. 1).

In fact, there is a continuous process of energy exchange between the soil and the roots of the plants, and the atmosphere [11].

In case of unequal electric potentials that determine the energy levels of localized volumes or macro-zones, the charges move between them. There is an electric current I_n and its value can be determined with the help of the empirical equation:

$$I_n = K_{np} \int V \cdot \omega \cdot C \cdot T \cdot dV, \quad (2)$$

where K_{np} is a proportionality coefficient which takes into account the influence of external conditions;

V is the amount of the localized zone which is equal to $V = 0,4 \text{ m}^3$;

ω is the soil moisture;

C is the concentration of ions of the soil solution;

T is the temperature of the environment of the biological object 'soil-plant'.

Experimental research proves that if K_{np} is equal to 1.25 and there are corresponding natural conditions of humidity, ion concentration and soil temperature, then the value of the electric current I_n varies within the limits of 0.07 ... 0.14 A, which is its density j_a on the surface of the anode zone of the biological object 'soil-plant' in the range of 0.02..0.06 A/m²:

$$j_a = I_n / S, \quad (3)$$

where S is the surface area of the anode zone.

Soil moisture with the dissolved salts is a kind of an electrolyte. When a steel conductor is placed into the soil, then on its surface the cathode and anode zones are formed as a result of redox reactions, and the metal gradually dissolves. As a result, there appears a difference of potentials on the interphase boundary that reaches 40-50 mV. It is also formed between the two wires laid in the soil and it varies considerably depending on the humidity and temperature of the soil, its mechanical composition, the amount of fertilizers and other factors. As a rule, with the changes the Moon phases and the weather, the value of the electric force of the natural origin (agricultural solar energy propulsion) varies not only by magnitude but also by the polarity.

During the first stage of the field experiment a special paraplough was laying steel wire with diameter of 2.5 mm, which was rolled from the drum along the bottom of the ground trench at depth of 40 cm [6]. Having reached the end of the pass, the tractor driver switched on the hydraulic system for lifting mode and the working part expanded from the ground, and the wire was cut at the height of 25 cm from the surface of the soil. The operation was repeated every 12 m in width. It should be noticed that the wire placed in this way does not obstruct to conduct agro-technical work. If necessary, the steel wires were easily removed out of the ground using a wire reel.

Since the electrodes have different polarity, there appears a closed electric circuit between them in a wet soil. That causes the emergence of a constant current from 4 to 6 $\mu\text{A}/\text{cm}^2$ (Fig. 2). Passing through the soil solution as the electrolyte the

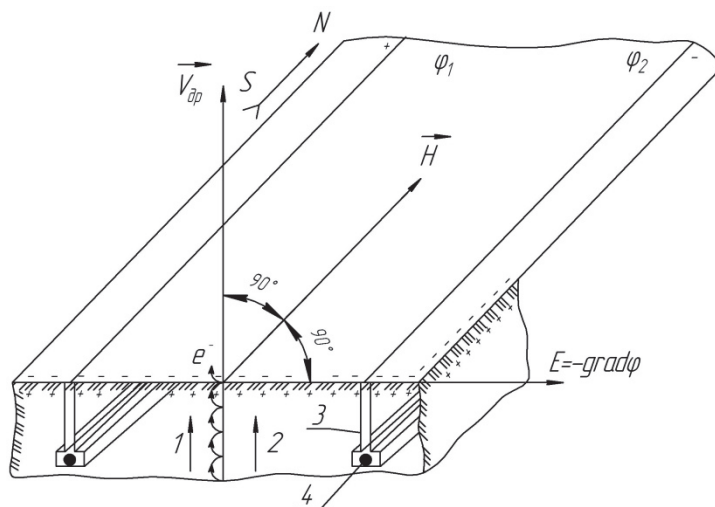


Fig. 2. Schematic layout of the movement of the charged particles of the substance in the soil solution:
1 – electrons; 2 – ions; 3 – lane; 4 – the wire laid on the bottom of the lane.

current supports processes of electrophoresis and electrolysis in the fertile layer. Due to this all chemicals necessary for the plants are transmitted from hardly assimilable into easily assimilable forms. Moreover, under the influence of the electric current, all plant residues, weed seeds and animal organisms are more likely to be humified, which increases soil fertility.

The ferromagnetic steel wires with the diameter of 2, 5 mm were put on the bottom of the agricultural tile at the distance of 12 m. The wires were laid on the fields of the farm “Rosia” in Novoukrainka district of Kirovohrad region. The period of their complete decomposition 10 to 12 years. On the experimental areas, the yield of the grain crops increased from 3 to 8 centners per hectare compared with the test areas (moldboard and sub-surface cultivation).

A subsurface tiller with the added chisel plough was used at the second stage of the research (Fig. 3).

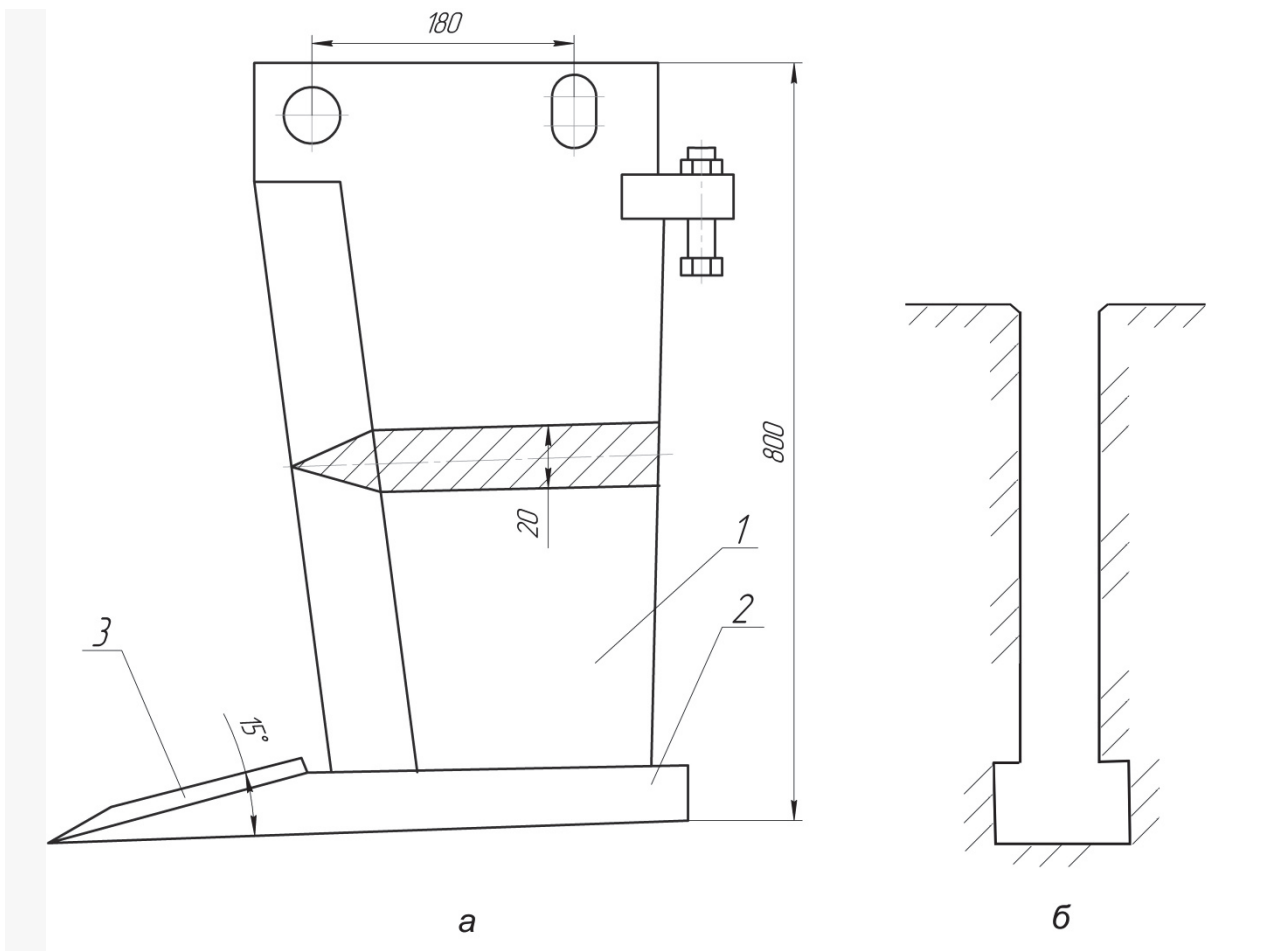
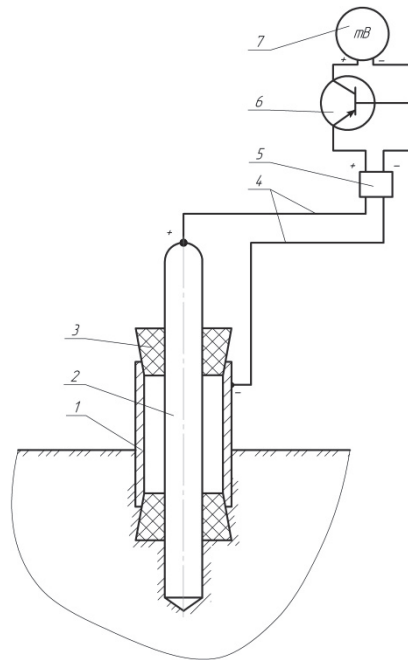
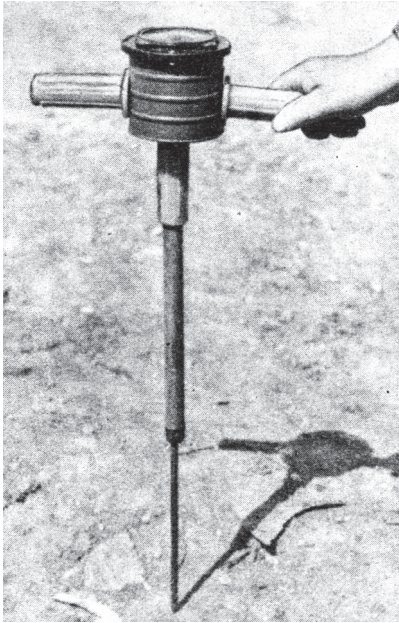


Fig. 3. Chisel plough (a) and the form of slit-drain: 1 – leg; 2 – tine sweep point; 3 – chisel.

The systems of slit-drain of the half-open type were laid in the soil at the depth of 40 cm in the direction from north to south at the distance of 3 m from each other. They play the role of electrolytic channels of the natural galvanoelectrical bath [7]. For the measurement of agricultural solar energy propulsion, the Agro-01 device [8] (Fig. 4) was developed which allows quantifying the energy status of the soil and crops including the methods of monitoring biological objects in field conditions.



a

б

Fig. 4. The schematic layout (a) and general view (б) of the "Agro-01" device:

1 – cathode; 2 – anode; 3 – dielectric bush; 4 – rod-conductors;

5 – switch; 6 – transistor; 7 – electric meter.

For four years the soil slotting for sowing wheat, corn and soybeans was carried out on the fields of LLC "Satori-S" of Kirovohrad region on the area of 3000 hectares. As a result of the introduction of the new technology soil fertility has been increased and the yields were increased by 12-15% correspondently.

Conclusions

The research of the electrochemical processes that take place in the soil with the continuous action of the energy of the Earth's electromagnetic field has revealed a positive influence on the processes of agrotechnical methods of soil cultivation. Laying of the ferromagnetic steel wires on the bottom of the slit-drains in the north-south direction increased the harvest of grain crops from 5 to 8 centners per hectare. The combination of surface soil cultivation with simultaneous slotting at the depth of 40 cm for sowing of wheat, corn and soybeans increased yield by 12-15%.

Bibliography

1. Cherenkov A.D., Avrunin O.G. (2014). Primenenie nizkoenergeticheskikh EMP dlya upravlyayushogo vozdeystviya na biofizicheskie processy v biologicheskikh obektah. [Application of low-energy EMFs for the control effect on biophysical processes in biological objects]. *Energoberezhenie. Energetika. Energoaudit*. 8 (126):62–65. [in Russian].
2. Kosulina N.G., Cherenkov A.D. (2016). Mikrovolnovaya tehnologiya v sadovodstve. [Microwave technology in gardening]. *Enerhetyka ta kompiuterno-intehrovani tehnologii v APK*. 1:67–68. [in Russian].
3. Pavlenko S.I., Seleznev G.P., Kucenko Yu.N., Olejnik G.I. (2010). Issledovanie bioelektricheskikh yavlenij v rastitelnykh organizmach. [Investigation of bioelectric phenomena in plant organisms]. *Nauchno-tehnicheskij progress v selskohozyajstvennom proizvodstve*. Materialy mezhdunar. nauchno-prakt. konf. Minsk,. 1:62–66. [in Russian].
4. Kutsenko Yu.M., Lukashenko M.I. (2006). Zastosuvannia enerhii EMP v tehnolohichnykh protsesakh pererobky silskohospodarskoi produktsii. [Application of EMF energy in technological processes of processing agricultural products]. *Naukovi dopovidi NAU*. 1:1–15. [in Ukrainian].
5. Bazarov E.I., Shirokov Yu.A. (1987). Agrozoo-energetika. [Agro-energy engineering]. Moskva: Agroizdat. 156. [in Russian].
6. Evreinov M.G. (1958). Primenenie elektricheskoy energii v selskom hozyajstve. [Application of electric energy in agriculture]. Moskva: Selhoozgidz,. 499. [in Russian].
7. Ivanko I.P., Shmat S.I. et al. Patent 21660A Ukraina, MPK A01S 7/00. Sposib vyroshchuvannia zernovykh ta inshykh silsko-hospodarskykh kultur. [A method of growing cereals and other crops]; zaiavnyk i patentotrymach Ki-ro-vohrad. instytut silskohospodarskoho mashynobuduvannia. № 95031113; zaiavl. 20.01.1998; opubl. 30.04.1998, Biul. 2. [in Ukrainian].
8. Glaser R. (2012). Biophysics. An Introduction: second edition. Springer. 407 p.
9. Sviren N.A., Shmat S.I., Fedorchak V.V. (2012). Preobrazovanie energii geoelektromagnitnogo polya Zemli i ee racionalnoe ispolzovanie v selskom hozyajstve: *monografiya*. [Transformation of the energy of the geoelectromagnetic field of the Earth and its rational use in agriculture]. *Kirovograd: KOD*. 192. [in Russian].
10. Ivanko I.P., Zrazhva S.G., Martynenko A.I. et al. A.s. 1450785 SSSR, MKI A01G 7/00. Sposob diagnostiki uslovij zhizneobitaniya bioobekta. [A method for diagnosing the conditions for the life of a bioobject]. № 4081342/30-15; zayavl. 11.05.1986; opubl. 15.01.1989, Byul. № 2. [in Russian].
11. Ivanko I.P., Shmat S.I. et al. Pat. 20258A Ukraina, MPK A01V 79/00. Sposib obrobitku gruntu. [Method of cultivating the soil.]; zaiavnyk i patentotrymach. Kirovohrad. instytut s.-h. mashynobuduvannia. № 95083620; zaiavl. 01.08.1995; opubl. 27.02.1998, Biul. 1. [in Ukrainian].