

# СЕЛЬСКОЕ И ЛЕСНОЕ ХОЗЯЙСТВО

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## INNOVATIVE ADAPTIVE AGRONANO TECHNOLOGY

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**Abstract.** The article is devoted to research of innovative adaptive agronano-technology in Kazakhstan. Definitions of humic preparations of lake sapropel are given, short theoretical aspects of the mechanism of effect of humic preparation on plants are given. Methods of receiving humin containing products at a high level – technology of mechanical chemical activation are described. Results of the research innovative (nano and biophysical) agrotechnologies on the example of processing of seeds and plants, various crops during 2006-2016 in Kazakhstan are explained.

**Keywords:** Humic preparations HUMIN PLUS, sapropel, nanotechnology, fuzzy logic, networks of indistinct controllers, logic-probabilistic approach

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**Аннотация.** Статья посвящена исследованию инновационной адаптивной агронанотехнологии в Казахстана. Даны определения гуминовых препаратов озерного сапропеля, приведены краткие теоретические аспекты механизма действия гуминовых препаратов на растения. Описаны методы получения гуминосодержащей продукции на высоком уровне – технология механохимической активации. Изложены результаты исследования инновационных (нано и биофизических) агротехнологий на примере обработки семян и растений, различных сельскохозяйственных культур в период 2006-2016 гг. в Казахстане

**Ключевые слова:** гуминовые препараты, HUMIN PLUS, сапропель, нанотехнология, нечеткая логика, сети нечетких контроллеров.

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**Түйіндеме.** Мақалада Қазақстанда инновациялық бейімді агронанотехнологияны зерттеу туралы сөз қозғалады. Көлдік сапропельден алынған гуминдік препараттарға сипаттама беріліп, теориялық тұрғыдан олардың өсімдікке әсер ету механизмі келтірілген. Гуминді тектес заттарды алудың жоғары белсенді технологиясы – механикалық-химиялық жолмен алу тәсілін көрсетті. Ауыл шаруашылығы тұқымдарын егістікке себер алдында құрамында металдардың нано және макро бөлшектері бар биофизикалық стимуляторлармен және электромагниттік өріспен өңдеудің 2006-2016 жылдары Қазақстанда жүргізілген тәжірибенің қорытындысы келтірілген.

**Түйінді сөздер:** гуминдік препараттар, HUMIN PLUS, сапропель, нанотехнология, бұлдыр логика, айқын емес бақылау торы.

**Introduction.** Biological systems constantly are under the influence of natural and artificial sources of an electromagnetic field and during evolution they developed mechanisms of information perception on the state of environment by means of interaction with electromagnetic field [1]. The crop production as constituent of a biological system has to develop on the terms of adaptability, i.e. increase in a role of mechanisms and structures, activation of a biological self-regulation of plant seeds to agroecosystems and an agrolandscape in general.

In terms of adaptability the greatest interest and prospect at processing seeds of various crops are represented by the electromagnetic nanotechnologies combined with use of organic complex regulators of plants growth on the basis of ecologically friendly extract of sapropel. By means of such technologies it is possible to influence directly the physiology and biochemical processes of a vegetable organism, without affecting and without modifying the genetic structure of plants [2]. The primal problem of such processing of seeds is in filling their power losses caused by adverse conditions of cultivation or storage and, above all to give to the biological systems of a seed such qualities which will prove to be positive during all biological cycle [3.] The integration research in a uniform technological chain of magnetic water treatment, seeds and environmentally friendly regulators of growth on energy of germination of wheat seeds represents a great practical interest.

**Material and methods.** Preparation of multipurpose action HUMIN PLUS. humin containing preparations made of peat, lignine and boring coal, differs in HUMIN PLUS:

1. Raw materials: HUMIN PLUS is made from the non-polluting lake sapropel, containing water-soluble, easy and difficult hydrolyzed substances, humic (GC), hymatomelanic acid (GMA) and fulvic acids (FA), wide range of amino acids, sugars, peptides, cellulose, lignin, lipids, carotinoids, xanthophylls, alcohols, ketones, carboxylic acids, chlorophyll derivatives, alkaloid, metal-porphyrins, phospholipids, vitamins, enzymes, antibiotics, steroid connections, HUMIN PLUS preparations contain expanded structure of microcells in the form of metalloorganic complexes.

2. Technology: In order to produce HUMIN PLUS the following components are applied:

- Gas tornadic ultrasonic reactors resonators with magnetic activation - German patent DE 10 2009 043 821 A1;

- physical methods of extraction and original technology of separation active ingredients from sapropel, allowing to refuse reagent (chemical) traditional technology;

**Multifactorial impact on plants and a soil biota:** Firstly, the **preparation** comprises all scale nutritious macro - and microcells, and operates as the chelating agent. Secondly, it is favorable to growth of good bacteria. Multifactorial action increases immunity of plants and its productivity.

**Results and discussion.** Productivity of agronano technology throughout 2006-2016 y are researched in the Sarkand and Panfilov regions of Almaty area. It is established by researches [3-5] that described technology influences the initial beet plants' ontogeny stages, in particular, on energy of seeds germination (table 1).

**Table 1 - Technology and dynamics of emergence of sugar beet's seedings**

Options	Day after crops, piece on 1 item of m.			
	5	8	10	10
Control	11	13	15	15
Experiment	15	22	24	26

**Table 1 - Agronanotechnologies and growth indicators of colza at the initial stages of development**

Experience options	Germination capacity, %	dry mass of a plant, mg	volume of root system of a plant, cm <sup>3</sup>
Control	48,5±4,3	150,0±5,5	105,0±5,8
Experiment	65,0±3,2	202,0±6,7	101,0±8,7

Also [2] the influence of agronano technology on energy of seeds germination of spring-field in vitro was studied (figure 1-4). Analysis of the experimental data showed that collected information insufficiently legibly describes influence of described technology of magnetic water treatment and regulators of growth on energy of wheat and coleseed germination. In this regard the adaptive and neural system of an indistinct logical conclusion was applied to interpretation of the experimental data.

The adaptive and neural system of an indistinct logical conclusion falls into hybrid systems. Hybrid systems give the chance to consider experience of experts, to use indistinctly provided information and also to take knowledge from these field experiments.

Graphical representation of results of indistinct model operation is shown in figures 1 - 4.

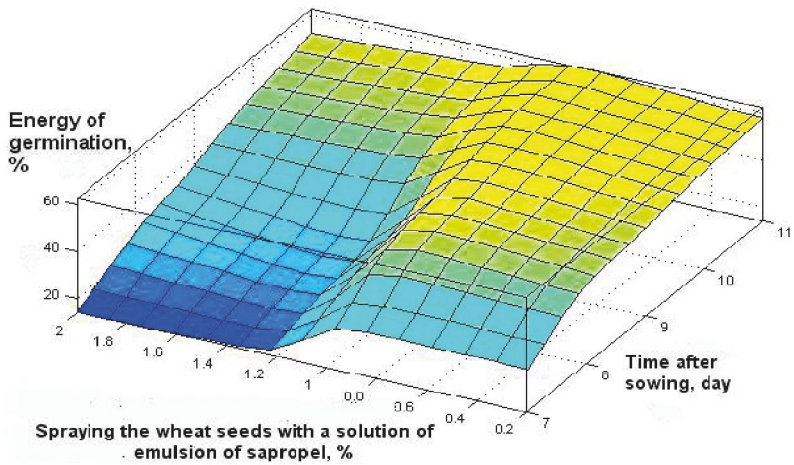


Figure 1 - Dependence of energy of germination of wheat seeds (water isn't exposed to magnetic processing from the procedure of spraying the wheat seeds with a solution of sapropel emulsion (water isn't treated magnetically) and time after sowing, day

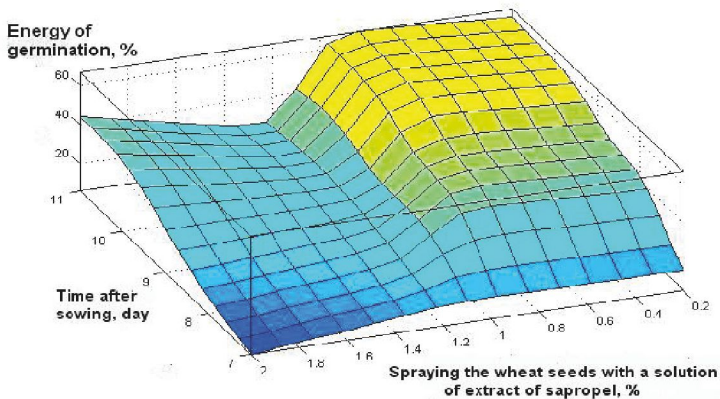


Figure 2 - Dependence of germination energy of wheat seeds (water isn't exposed to magnetic processing from the procedure of spraying the wheat seeds with a solution of sapropel emulsion (water isn't treated by the magnetic processing) and time after sowing, day.



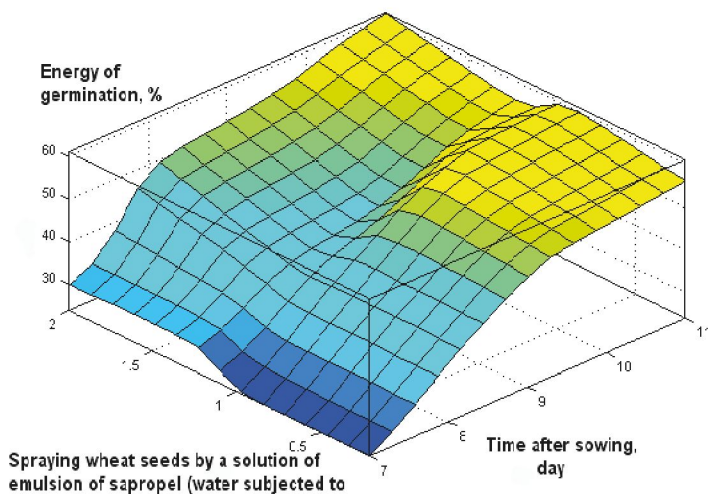


Figure 3 - Dependence of germination energy of wheat seeds of wheat from the procedure of spraying the wheat seeds with a solution of sapropel emulsion (water subjected to magnetic treatment) and time after sowing, day.



Figure 4 - Dependence of germination energy of wheat seeds of wheat from the procedure of spraying the wheat seeds with a solution of sapropel emulsion (water water subjected to magnetic treatment) and time after sowing, day.

The main characteristics of tutoring process of an indistinct logical conclusion system are shown in figures 5 - 6.

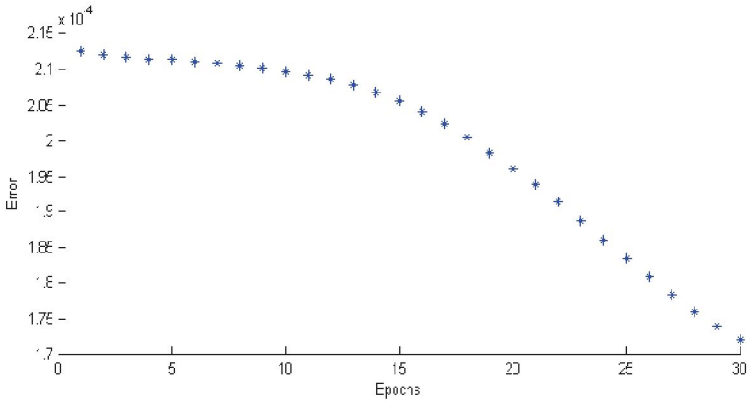


Figure 5 - Interrelation between an error in the course of tutoring (Error) and quantity of tutoring cycles (Epochs) (at creation of the dependence shown in fig. 3).

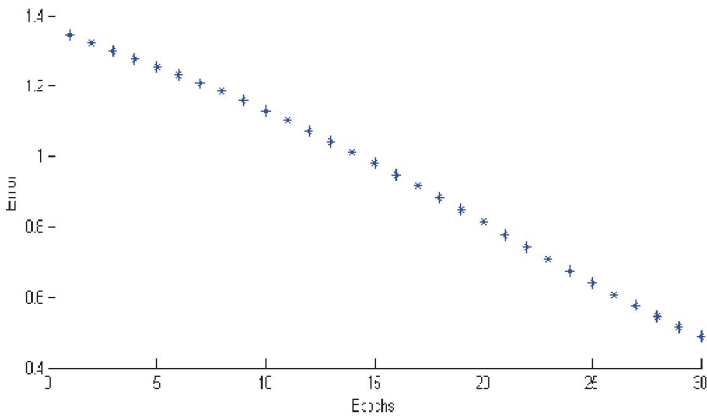


Figure 6 - Interrelation between an error in the course of tutoring (Error) and quantity of tutoring cycles (Epochs) (at creation of the dependence shown in figure 4).

Comparison of the data provided on figures 1 and 3 shows that at magnetic water treatment of germination energy of wheat seeds, processing by solution of sapropel emulsion is slightly higher at the end of the periods observed. At the same time influence of differences in solution strength of a sapropel emulsion on the size of energy of seeds germination is shown only during an initial stage of observations. Comparison of the data provided on figures 2 and 4 shows that at magnetic water treatment of germination energy of the wheat seeds sprayed with sapropel extract solution too is slightly higher at the end of the period of observations. In particular, if solution strength of sapropel extract varies in the range [1.2 - 2%] (diagram 2), then energy of germination of seeds is equal to 30 - 40%. At magnetic water treatment (diagram 4) if solution strength of sapropel extract varies in the same range, then to germination energy of seeds it is equal to 70 - 80%.

Results of the experimental data analysis showed that the effectiveness of magnetic water treatment depends on the used regulators of growth and their concentration.

**Conclusions.** Tests of innovative adaptive agronanotechnology in Kazakhstan have showed existence of the improvement effect of germination energy and viability of colza seeds, sugar beet. However the optimization and synchronization of magnetic field parameters is necessary for identification of more pronounced effect of application integrated technologies in a uniform production cycle when seeds are being processed on viability and energy of germination (spring wheat) at impact on seeds and water and concentration of organic regulators.

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