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Aim of the research

- Studies of biological activity of humic substances of Humate Green OK,
- to determine ways to use,
- develop recommendations for their application.

Materials and methods

Biological activity was evaluated on the base of indications of germination power of seeds of vegetables, legumes and cereal crops treated with a solution of *Humate Green OK* with concentration of humic substances 0.005%.

During the vegetation period, plants were treated with the preparation twice:

- 1) right after full germination
- 2) two weeks after the first treatment.

For plant preparation of seed so-called "cup method" was used. Seeds were soaked in quantity of 50 pieces in four replications of the tested solution and control group in distilled water. Next, the seeds were spread out between layers of filter paper in the "petri dishes" and were kept in an incubator at a temperature of 20 ° C for 7 days for grain and 12 days for grass with daily humidifying.

The plants spraying of solution of Humate Green OK was performed manually using atomizer at a rate of 50 ml per 1m².

The fresh weight of shoots and roots was measured. Additionally were evaluated indications of the accumulation of fresh weight of plants and roots grown in the soil after pre-processing of seeds and double treatment of seedlings after full germination and after 2 weeks.

The plants vegetation was carried out in a cabinet with light, temperature and humidity control - HOTCOLD-6L.

The rate of germination energy was calculated and expressed in relation to the control on the 3rd-4th day. After 7-12 days of germination seed sprouting was also measured.

Biological activity of *Humate Green OK* was evaluated on the same cultures by growth data of crude vegetative mass and the mass of roots, and ratio was expressed as a percentage according to the control.

Planted species: wheat (*Triticum aestivum*), barley (*Hordeum vulgare*), peas (*Pisum sativum*), cabbage (*Brassica oleracea*), meadowy fescue (*Festuca pratensis*), red fescue (*Festuca rubra*), Italian ryegrass (*Lolium multiflorum*), Common Meadow Grass (*Poa pratensis*).

Results

Compared with the control (*Kontrole* - without treatment with *Humate Green OK*) energy of germination of grain (barley, wheat) increased by 8-26% (Photo 1, 2), forage grass and sward (clover red, perennial ryegrass, tall fescue, red fescue, Common Meadow Grass) by 7-14%, peas 25%, cabbage to 7-12%.

Sprouting of seed compared with the control increased from 6-19% for grain, for forage grass and sward from 5-19%, 16% for peas, for cabbage from 5-10% (Table 1).



Photo 1 Seed sprouts of summer barley

Photo 2 Sprouts of summer barley

Table 1 Energy of germination of seeds

Crops	Energy of sprouting, %	Germination, %
Barley	26	19
Wheat	8	6
Cauliflower	7	5
Cabbage	12	10
Peas	25	16
Clover	10	10
Ryegrass	8	5
Red fescue	7	8
Meadow fescue	12	10
Common Meadow Grass	14	19

Results and Conclusions

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Results

The results of the tests showed that after pre-treatment of seeds and double-fold spraying of plants with the 0,005% humic substances of *Humate Green OK* during 3 weeks of the growing season of plants the development of the root system has improved, it is branching stronger and penetrating deeper into the soil (Photo 3, 4). It decreased the number of plants affected by basal rot for cereals by 33,3-37,5% in comparison with the control.

As a result, vegetative and root mass increased for spring wheat from 38-25%, for barley from 35 - 48%, for ryegrass from 14 - 16%, from 24-32% for meadow fescue and for peas from 27 - 50% (Table 2).

Table 2 Effect of Humate Green OK on the development of plants seedling

	<i>Plant height, cm</i>	<i>% of diseased plants</i>	<i>Weight of plants, %</i>	<i>Mass of roots, %</i>
Summer wheat				
Control	16-18	16	100	100
Humate Green OK	18-20	10	138	125
Spring barley				
Control	13-15	18	100	100
Humate Green OK	15-17	12	135	148
Perennial ryegrass				
Control	21-22		100	100
Humate Green OK	23-25		114	116
Red fescue				
Control	13-14		100	100
Humate Green OK	15-16		124	132
Peas				
Control	11-13		100	100
Humate Green OK	18-21		127	150



Photo 3 Root system of cabbage



Photo 4 Root system of peas

Conclusions

Humate Green OK solution with concentration of humic substances 0.005% has showed a high stimulating activity on various agricultural crops. Increased by the humic substances fresh mass of plants reached 25-50%, depending on the culture as compared with control.