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Influence Of Pre-Sowing Treatment Of Seeds On Growth, Development And Productivity Of Soybean Varieties

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Abstract: The article presents the results of the action of ultraviolet rays and low-frequency electromagnetic radiation on seed germination, growth, development and yield of soybean varieties. The combined action of the studied factors on seeds led to an increase in seed germination, which depended on the shelf life of the seeds and the exposure of the impact. A reduction in the growing season by 3-7 days of the studied soybean varieties is shown. An increase in the productivity of soybean plants was revealed depending on the methods of pre-sowing seed treatment.

Key words: soybean varieties, ultraviolet rays, electromagnetic radiation, seed germination, growth, productivity.

1. INTRODUCTION.

Nowadays, soybeans have become an important crop due to their wide range geographic adaptation, nutritional value and application possibilities.

Soy provides about 60% of vegetable protein and 30% of vegetable oil in the world. Due to its unique chemical composition, soybeans are used in food, livestock, technical and pharmaceutical industries. It plays an essential role in the national programs of many countries.

In this regard, the interest of scientists in this culture is growing: new soybean varieties are created every year, bioecological, physiological and biochemical properties of various genotypes are studied, regional agricultural technologies for the cultivation of soybean varieties are developed [1-4]. The genetic potential of modern soybean varieties is 50-60 c / ha, in practice 35-50% of the genetic potential of the crop yield is realized. Plants in the process of their development from seed to maturation are in a complex interaction with the environment, i.e. are influenced by stress factors (low or high temperatures, soil salinity or drought, pesticide loads, etc.). Therefore, further growth of effective soybean production is possible by improving the cultivation technology and using modern adaptive varieties.

Along with the creation of varieties of the intensive type, the wide use of physiologically active substances and factors that protect the plant from the influence of harmful environmental influences, preserve and improve the valuable economic indicators of agricultural products, has great prospects in this direction.

The limiting possibilities of adaptation of plants to harmful environmental factors are determined by their genotype. However, it is not always fully utilized. Hence, there is a significant spread in seed germination, vegetative growth rate, plant survival, etc. in plants of the same species and variety. Therefore, the cultivation of plants in unfavorable conditions involves the use of various methods of increasing plant resistance. One of the effective ways to achieve this goal is to improve the quality of the seed by acting on the seeds with various factors. Of all the agrotechnical measures, the pre-sowing treatment of seeds is effective in terms of the ratio “increase in yield / cost of implementation”, therefore, a large number of methods of pre-sowing treatment of seeds are currently known. There are known methods of pre-sowing treatment of seeds, with the help of which it is possible to increase the germination of seeds lost during storage. Ionizing radiation in small doses, sonication, short-term thermal shock-wave treatment, exposure in electric and magnetic fields, laser, irradiation with light of various wavelengths (ultraviolet, red, infrared), water activated in various ways, pre-sowing soaking in solutions of biologically active substances and others can increase seed germination, the rate of growth and development of plants and their yield. Among the numerous methods of pre-sowing stimulation, the most promising are electromagnetic fields and ultraviolet rays [7, 8, 9]. Seed treatment allows you to make fuller use of their potential. Research on the effectiveness of methods of physical influence on seeds and vegetative plants has been clearly insufficient; however, the data obtained are sometimes contradictory. Therefore, studies to identify the effectiveness of physical methods of pre-sowing treatment of seeds of agricultural plants are relevant in the development of modern environmentally friendly technologies for their cultivation.

In this regard, we conducted experiments to study the effect of ultraviolet rays and electromagnetic radiation on seed germination, growth and development, as well as the productivity of various soybean varieties.

2. MATERIALS AND RESEARCH METHODS.

The objects of research were soybean varieties of various ripeness groups: Sava, Victoria, Favorit. The studies were carried out in 2017-2019 at the experimental site of the Botanical Garden of the National University of Uzbekistan.

The soils of the experimental plots are represented by typical sierozem, the fertility is average. The humus content in the arable horizon is 1.15-1.22%, in the subsoil - 0.90-1.05%. The content of total nitrogen in the arable layer is 0.09-0.11%, total phosphorus - 0.13-0.14%. In the subsoil, the content of total nitrogen is 0.08-0.09%, total phosphorus is 0.12-0.13%. The total potassium content in both soil horizons is very close - 1.30-1.32%.

The mobile forms of soil nutrients vary. Thus, the mobile form of nitrate nitrogen in the arable layer is 42.10 mg / kg, in the subsoil - 38.9 mg / kg. The mobile form of phosphorus changes little (in the arable layer - 23 mg / kg, in the subsoil - 21 mg / kg.). The content of exchangeable potassium in the topsoil is 180 mg / kg, and in the subsoil - 163 mg / kg.

The application of mineral fertilizers was carried out in two steps: half of the nitrogen fertilizers were applied before sowing, and the second - at the beginning of the flowering phase; phosphorus and potash fertilizers were applied during sowing.

Sowing of experimental soybean seeds of varieties "Sava" and "Victoria" was carried out on April 12, 2019.

The seeding options are shown below:

1-2 rows - control (seeds not exposed to UV radiation, EMF);

3-4 row - irradiated seeds of UFO + EMF for 15 minutes;
5-6 row - irradiated seeds of UFO + EMF for 20 minutes;
7-8 row - irradiated seeds of UFO + EMF, time 25 minutes;
9-10 row - irradiated seeds of UFO + EMF, 30 minutes in time;
Agrotechnical methods of growing soybeans in the experiments were applied on the basis of existing
recommendations for this crop [5]

Sowing was carried out with a row spacing of 60 cm, the seeding depth was 4-5 cm, the seeding pattern was 60x15 cm. The experiments were repeated three times. The area of the experimental plots is $30m^2$. Site selection and experiments, sampling and phenological observations were carried out according to generally accepted methods [6]

Seeds of soybean varieties were irradiated with ultraviolet rays (wavelength 290-310nm) and electromagnetic radiation (4 Hz., 200-500 nTs) in the laboratory of OJSC "BMKB-AGROMASH" for 15 minutes, 20 minutes, 25 minutes, 30 minutes separately, and together, the day before the experiments (sowing).

Seed germination of the studied soybean varieties was determined according to the method of state variety testing of agricultural crops [5] and according to GOST 12038-84.

During the growing season, watering is carried out 3-4 times, cultivation 2-3 times and weeding from weeds at least twice.

Seed germination and germination energy were determined according to the Methodology of state variety testing of agricultural crops [5] and according to GOST 12038 - 84. Agricultural seeds. Germination methods (2011). The experiments were carried out in laboratory conditions. Treated and control (untreated) soybean seeds were germinated in 50 enamel cuvettes. in each sample at a temperature of + 25^0C in a thermostat ED 53 (± 0.3^0C)

3. RESULTS AND ITS DISCUSSION

It is known that the action of environmental factors has a particularly strong effect on the initial stages of germination, since this period is characterized by an intensive metabolism, as a result of which reserve substances of seeds are converted into vital compounds used by seedlings for the formation of new tissues. The emergence of seedlings, the formation of seedlings, the growth, development of plants and, ultimately, their productivity largely depends on the nature of the physiological and biochemical processes that occur during seed germination. One of the methods of regulating these processes is seed treatment before sowing. Depending on the type of plant and the goal pursued, various methods of pre-sowing seed treatment are used.

In this regard, we studied the effect of ultraviolet rays and electromagnetic radiation on the germination of seeds of various varieties of soybeans.

As a result of the laboratory experiments, the optimal exposure time of the pre-sowing treatment of seeds of various soybean varieties was revealed.

Table 1
Influence of pre-sowing treatment of soybean seeds of varieties Sava and Victoria on their germination

№	Experience options	Exposure time	Germination %	
			Sava	Victoria
1	Control	–	97,5	96,8
2	UFO	15 min	97,5	97,0
3	UFO	20 min	96,8	96,5
4	UFO	25 min	97,6	97,1
5	UFO	30 min	92,9	94,0
6	Control	–	97,7	97,1
7	EMF	15 min	96,8	96,8
8	EMF	20 min	96,1	96,5
9	EMF	25 min	98,3	98,0
10	EMF	30 min	94,2	95,3
11	UFO + EMF	15 min	96,8	97,4
12	UFO + EMF	20 min	98,0	98,2
13	UFO + EMF	25 min	98,5	98,7
14	UFO + EMF	30 min	95,4	95,8
15	UFO + EMF	40 min	90,3	91,4

* The average of the three definitions is given.

As can be seen from the data presented in Table 1, the treatment of seeds of two varieties of soybeans with a high germination ability (germination capacity) with ultraviolet rays and low-intensity electromagnetic radiation does not lead to significant changes. At the same time, an increase in the exposure time with UFO and EMF, as well as their combined effect, causes a decrease in the germination of soybean seeds.

In experiments with a batch of soybean seeds stored for 3 years, it was shown that irradiation of seeds with ultraviolet rays and electromagnetic radiation leads to an increase in their germination. An increase in the duration of exposure (both separately and jointly) leads to a decrease in the germination ability of soybean seeds of varieties Sava and Victoria (Table 2).

Table 2
Influence of pre-sowing treatment of soybean seeds of varieties Sava and Victoria, stored for 3 years on their germination

№	Experience options	Exposure time	Germination rate%	
			Sava	Victoria
1	Control	–	82,0	81,4
2	UFO	15 min	83,1	81,9
3	UFO	20 min	86,4	85,1
4	UFO	25 min	85,3	86,6
5	UFO	30 min	80,2	81.1

6	Control	–	82,4	81,8
7	EMF	15 min	84,5	84,2
8	EMF	20 min	87,9	89,6
9	EMF	25 min	89,0	89,3
10	EMF	30 min	84,3	85,1
11	UFO + EMF	15 min	89,0	88,5
12	UFO + EMF	20 min	88,2	90,3
13	UFO + EMF	25 min	87,7	89,0
14	UFO + EMF	30 min	87,3	88,2
15	UFO + EMF	40 min	79,6	80,1

* Average data of three definitions are given.

Thus, the effect of the pre-sowing treatment of soybean seeds is most significantly manifested in “aging” seeds (7.0-8.9%). This is most noticeable in soybean seeds of the Victoria variety. The same tendency to increase the germination rate of soybean seeds was found in experiments carried out in 2017.

Sowing of soybeans as the main crop was carried out on April 12, 2019.

After sowing soybean seeds, the beds were immediately watered. Plant care was reduced to weeding and loosening of row spacings, watering and applying mineral fertilizers.

Phenological observations were carried out every 10 days of the growing season. The following phases of soybean vegetation were noted: seedling, budding, beginning of flowering, bean formation and ripening.

On June 8, single specimens of the red-headed dowel (Elateridae) were found in soybean plants. The crops were treated with a bagheera + karate tank mixture of insecticides.

The results of phenological observations of the growth and development of various soybean varieties are shown in Table 3.

As can be seen from the data presented, the transition from one phase to another occurred at different times and the duration of the interphase periods was different. So, the sowing period - shoots in the early maturing variety was 4-5 days, in the late ripening varieties - 8-10 days, the sowing period - flowering in the early maturing variety - 47-49 days, in the late-ripening varieties - 54-62 days.

In general, there were significant differences in the duration of the growing season between varieties. So, for the Favorite soybean variety, the growing season varies from 96 to 102 days, for the Sava variety - 120-125 days, for the Victoria variety - 110-115 days.In another series of experiments, soybean seeds pretreated with UFO and EMF were sown together for 15, 20.25 and 30 minutes. As shown by phenological observations, pre-sowing treatment of seeds of the studied soybean varieties led to a 3-10-day reduction in the period from full sprouting to mass flowering, and in general, the growing season. It is interesting to note that the treatment of soybean seeds with UFO and EMF leads to different results in terms of the number of beans and seeds on a single plant, however, the total seed productivity on a plant tends to increase.

Table 3

Phenological observations of the development periods of the studied soybean varieties

Soybean varieties	Days from sowing to						Vegetation period
	shoots	the appearance of the present. leaves	budding	bloom	the appearance of beans	ripening beans	
Victoria	8-10	17-18	45-48	54-59	65-68	105-110	110-115
Favorite	4-5	14-15	37-38	47-49	55-56	92-34	96-102
Sava	8-10	18-19	48-50	58-62	68-70	110-115	120-125

Table 4

Crop structure and productivity of Sava soybean variety depending on pre-sowing treatment

Options Experience	Plant height, see	Number per plant		Plant productivity, g.
		beans	seed	
Control	104,3	68,3	131,8	19,2
15 min cumulative.	110,5	62,5	160,1	25,3
20 min cumulative.	112,8	61,8	174,0	30,2
25 min cumulative.	108,7	59,9	162,4	29,0
30 min cumulative..	102,6	64,1	160,5	28,5

* The average data is given from four replicates.

Table 5

Crop structure and productivity of Victoria soybean variety depending on pre-sowing treatment

Options Experience	Plant height, sm	Number per plant		Plant productivity, g.
		beans	Seed	
Control	116	78	136	21,0
15 min cum.	118	120	180	27,9
20 min cum.	120	135	214	33,1
25 min cum.	116	132	186	28,2
30 min cum.	112	103	122	18,9

Table 6
Yield structure and productivity of the Favorit soybean variety depending on the presowing treatment

Options Experience	Plant height, sm.	Number per plant		Plant productivity, g.
		beans	Seed	
Control	75	31,5	85,0	13,0
15 min cum.	80	51,0	135,0	24,5
20 min cum.	90	48,5	108,0	27,0
25 min cum.	84	43,0	117,5	22,5
30 min cum.	86	44,5	123,0	20,0

The data given in tables 4-6 show that the productivity of different varieties of soybeans increases depending on the methods of presowing seed treatment. Thus, the highest productivity of seeds of one soybean plant was observed in the variant of combined exposure to UFO and EMF for 20 minutes; with a further increase in the exposure time, the magnitudes of the effect decrease. It is interesting to note that the same regularity of the combined effect of UFO and EMF is also observed in all studied soybean varieties.
Thus, the results of the research allow us to conclude that the pre-sowing treatment of the seeds of the studied soybean varieties with ultraviolet rays and electromagnetic influence increases their productivity. It should be noted that these results were obtained during two years of plant growth.

4. CONCLUSION

[1.] Treatment of the seeds of the studied soybean varieties with a high germination ability with ultraviolet rays and low-intensity electromagnetic radiation does not lead to significant changes in their germination. The effect of pre-sowing treatment of soybean seeds is most significantly manifested in "aging" seeds.

[2.] Phenological observations of the growth and development of soybean plants were carried out on the experimental plots of the Botanical Garden of the National University of Uzbekistan and "AGROBIOHOLDING" LLC in Yangiyul district.

[3.] The combined effect of UFO and EMF on seeds led to an increase in field germination of seeds. The greatest effect was found with a 20-minute exposure to UV and EMF.

[4.] The productivity of the studied soybean varieties increases depending on the methods of presowing seed treatment. At the same time, the highest productivity of seeds of one soybean plant was observed in the variant of combined exposure to UFO and EMF for 20 minutes; with a further increase in the exposure time, the magnitudes of the effect decrease.

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