Investigation of Influence of Every Plasma Treatment on Seeding Properties of Seeds of Agricultural

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Annotation: The article presents studies of the effect of a nonequilibrium low-temperature plasma of a high-frequency capacitive discharge on the amount of germination and the growth force of crops under various seed treatment regimes. On the basis of confocal laser scanning microscopy, the effect of treatment on the surface of seeds has been established. When germinating seeds, the positive effect of plasma treatment has been established.

Key Words: agricultural crops, seeds, pre-sowing treatment, germination, growth force, plasma, high-frequency gas discharge

INTRODUCTION

For today, the most common treatment method is the use of chemically active substances. Thus, fungicides are used to etch seeds and release spores from fungal and bacterial infections. One of such substances used in Uzbekistan is tiram, which belongs to the third hazard class and decomposes in the ground to more toxic and more dangerous metabolites: tetramethylmonosulfide and tetramethylthiourea[1-4].

Phenylpyrroles (fludioxonyl) does not have a toxic effect on plants and living organisms, but they differ in average resistance in the soil.

Studies are also being conducted on the effect of electro physical processing methods as growth stimulation. Thus, the possibilities of processing with ultrasound, concentrated electric and sunlight, and laser beams were investigated. The results of the study show unstable and ambiguous effects, which does not allow the use of such methods in large-scale production volumes, but their simplicity and unexplored potential make it possible for further research.

The paper investigates the possibility of using nanotechnology for pre-sowing seed treatment using multicomponent, multifunctional biologically active (nano)chips.

The Nano scale effect makes it possible for more active penetration of active substances into the plant. However, in this case, the possibility of a toxic hazard to seeds, plants and soil should not be excluded also due to the higher activity of nanoparticles.

As a pre-sowing treatment of seeds in this paper, it is proposed to use a non-equilibrium low-temperature plasma in the case of a low-pressure discharge. It should be noted that this technology is environmentally friendly, both for the environment due to the absence of chemically and biologically active substances, and for the cultivated crops themselves, speed, one-step, simplicity, the ability to accurately set technological parameters to achieve the

optimal treatment option and obtain the best result [5-13].

Studies on the effect of low-temperature plasma on seed germination and crop growth have already been conducted. Thus, it was noted that this treatment plays an important role in the growth of plants, physiological processes in them, is able to change the structure of the surface of seeds, stimulates germination and growth rates. According to the work where the germination and growth rate of tomatoes were studied, the active particles of atmospheric plasma that penetrate through the peel of seeds have an effect, accelerating the decomposition of the nutrient – endosperm, due to which a faster germination of the embryo occurs.

In this paper, it is proposed to investigate the effect of a low-temperature non equilibrium high-frequency capacitive.

In this scientific paper, it is proposed to investigate the effect of low-temperature no equilibrium high-frequency capacitive plasma with plasma-forming gases Ar, Ar/N_2, N_2 on germination and growth energy of seeds of various crops.

THE EXPERIMENTAL PART

Sowing seeds of common agricultural crops were selected as objects of research: corn, wheat, pumpkin.

Reproductive seeds of the first generation F1 hybrids were selected as prototypes due to widespread use. The technological parameters of the plasma treatment process were within the following limits: gas consumption (G) 0,02-0,1 g/s; discharge power (Wp) 3-5 kW; current at the anode of the generator lamp (Ia) 0,105 A; voltage at the anode of the generator lamp (U_a) 1-5 B; operating pressure in the discharge chamber (P) 26,6 Pa; treatment duration (τ) 3-5 min.

The surface of the seed samples – plasma-treated and control (not processed) - was studied using confocal laser scanning microscopy.

The germination rate of the embryo is influenced by the structure and thickness of the seed peel, as well as the presence of cracks, damage to the peel. The obtained surface images show the presence of large irregularities, chips, deeper cracks on the surface of samples that have undergone plasma treatment.

Based on the confocal laser scanning microscopy images obtained, it can be assumed that with partial destruction of the peel, the germination rate of the embryo will increase.

Seed germination was carried out according to the following method:

1. A sealed container was prepared, cotton pads were disinfected and placed on the bottom.

2. Put the seeds on cotton pads and covered them from above.

3. Moistened cotton pads.

4. The container was sealed, then stored in a dark place at room temperature 21–32 °C.

INFERENCE

The average germination time of the selected seed material is 3-7 days, according to the conclusion of 7 days, the germination and initial growth strength of experimental seeds and control samples were calculated.

According to the results of calculating the percentage of germination of seeds, it can be concluded that the plasma treatment mode: P = 26,1 Pa, t – 3 min, Ua= 3 kW, Ar and Ia = 0,4 A had the strongest positive effect on germination and growth rate. The percentage of germination with these technological parameters for corn, wheat, pumpkin seeds was 100, 90

and 100%, respectively, with the indicators of control (not processed) samples 77, 74 and 78%, respectively.

However, it should be noted that technological parameters with more intensive processing, such as: pressure P = 26,1 Pa, duration t – 3 min, voltage Ua = 5 kW, plasma-forming gas Ar / N_2 in a ratio of 70/30% and the current at the anode of the gen. lamp, Ia = 0,5 A have a detrimental effect on seeds most of the cultures taken. Thus, with the germination of control wheat samples at 74%, with these technological parameters, the indicator decreases to 15%.

Based on the studies conducted and the results presented, it can be concluded that plasma soil treatment with the use of plasma-forming gas Ar can significantly improve germination, namely by 21% on average and growth strength up to 38%. Therefore, it can be concluded that it is possible to use short-term treatment with a plasma HE discharge with sufficiently gentle parameters and plasma-forming gas argon to increase the germination and growth strength of crops. The study of the preservation of the intensity of the effect during long-term storage requires further, additional tests.

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