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Research Article

The Influence of Biostimulant Reglalg on Wheat Plants Resistance to Frost Dascaliuc Alexandru, Jelev Natalia

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Abstract

The preparations obtained by extraction of active substances from different organisms, when processing plants, are influencing their growth and response to abiotic and biotic stress factors. Their action is different from that of nutrients and synthetic preparations for plants protection. In the scientific literature, to distinguish them from other preparations, the term biostimulant was proposed. In this article we are included some examples of the effects of the biostimulant *Reglalg*, extracted from the biomass of algae *Spirogyra* sp., on the productivity and resistance of wheat plants to frost.

Keywords: Biostimulant *Reglalg*; Algae; Wheat; Abiotic Stress Resistance; Productivity

Introduction

Plants respond to the action of abiotic and biotic stress with sophisticated innate reactions induced by the signals being modified plant-derived or invading organism derived molecules [4]. Perception of these signals induces the changes in the expression of genes that are implicated in plants adaptation to stress conditions. Substances that induce increased resistance to abiotic and biotic stressors have been called adaptogens or protectors; those that induce resistance toward non-adapted pathogens also are known as "defense elicitors" [5]. Treating of plants in the absence of stress factors with extracts containing such signals, or components inducing their productions by plants themselves, can promote plant resistance to imminent action of stress in the future. Activation of plants growth and resistance to stress can be realized by the application of various substances, physiological effects of which are distinct from that of fertilizers and products for plant protection. It was proposed to unite them under a common term "biostimulant". Among numerous definitions of biostimulant, we mention only the European Union model definition: "A plant biostimulant is any substance or microorganism, in the form in which it is supplied to the user, applied to plants, seeds or the root environment with the intention to stimulate natural processes of plants benefiting nutrient use efficiency and/or tolerance to abiotic stress, regardless of its nutrients content, or any combination of such substances and/or microorganisms intended for this use" [7].

Products from algae, due to the presence of a series of compounds that promote plants growth and adaptation to stress conditions, are widely used in agriculture and are defined as biostimulants [9]. Here we provide information about the effects of *Reglalg* [6], the biostimulant extracted from freshwater algae of genus *Spirogyra*, applied for processing the seeds of various winter wheat varieties before sowing, on yields quantity and quality, as well as on the plants tolerance to frost.

Materials and Methods

In our study, the varieties of winter wheat Moldova 5, Albidum 114, Misia, and Cuialnic were used. The plants of the experimental variants were obtained from the seeds sprayed with solution of the biostimulant Reglalg diluted with water in specific ratios, while those of control variants - from the seeds sprayed with water. In

order to appreciate the genotype resistance to frost, at the initial stage of germination (before emergence of the central root) the seeds were exposed to different doses of shock with negative temperature (SNT), realized by incubating them in the air thermostat with specified temperature (-8, -9. -10, -11, -12, and -13°C) during 8 hours. Parameters of germination were determined after incubation the seeds on the wet filter paper, in the air thermostat, in the dark, at temperature 25°C and relative air humidity 75-85%. The control (sprinkled with water) and experimental (sprinkled with solution of Reglalg) seeds were also sowed in the field conditions. The parameters of plants resistance to SNT were determined after passing the first and second phase of hardening [3].

The statistical analysis was performed by determining the values of the means, standard deviation of means, and the significance of differences between variants with the level of confidence $p < 0.05$ [1].

Results and Discussions

The data shown in figure 1 demonstrates that for varieties of wheat, involved in research, the level of inhibition of seeds germination after exposure to SNT was different. The seeds primary resistance to SNT of the variety Albidum 114 was higher than that of the seeds of other three varieties. Mention that in control variants of all four varieties the level of seeds germination was higher than 98%. We can also point out that after SNT the level of germination of the seeds pre-treated with the solution of *Reglalg* was approximately 20% higher than that of those pre-treated with water. Thus, independently of the variety primary reaction to SNT, the protective effect of pre-treating seeds with the solution of *Reglalg* was approximately the same for all wheat varieties included in research. These data demonstrate that in the embryos of the seeds treated with the solution of the biostimulant *Reglalg*, even at the germination stage, are induced the processes that ensure the increasing their resistance to negative temperatures, independently of wheat genotype.

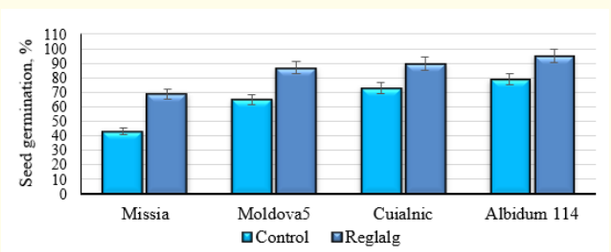

Figure 1: The percentage of wheat varieties Misia, Moldova 5, Cuialnic, and Albidum 114 seeds germination, which before exposure to sock with temperature -7°C, during 8 hours, were imbibed during five minutes in water (Control), or in solution of the Reglalg, diluted with water in ratio 1: 200, (Reglalg).

The beneficial effect of seed treatment prior to germination with the biostimulator *Reglalg* was also confirmed in the field conditions. The included in the figure 2 data demonstrate that after the first and second phase of hardening the resistance to negative temperatures of control plants of all varieties included in the research differed substantially. Their distribution in order of increasing the resistance to SNT was the following: Misia, Moldova 5, Cuialnic and Albidum 114. The transition from the first phase of hardening to the second one ensured the proportional increasing of the resistance to negative temperatures of the all varieties of plants. After the both phases of hardening, the resistance to SNT of the plants in experimental variants (obtained from the seeds treated before sowing with the solution of the biostimulant *Reglalg*) was significantly higher in comparison with that of the plants in control variants. Thus, the beneficial effect of *Reglalg* on winter hardening was more pronounced to the varieties of plants that are less resistant to the SNT. The data included in figure 2 also suggest that after the second phase of hardening, the plants in the experimental variants resist to the exposure of the shock with temperatures by 1-2 degrees lower compared to the control plants.

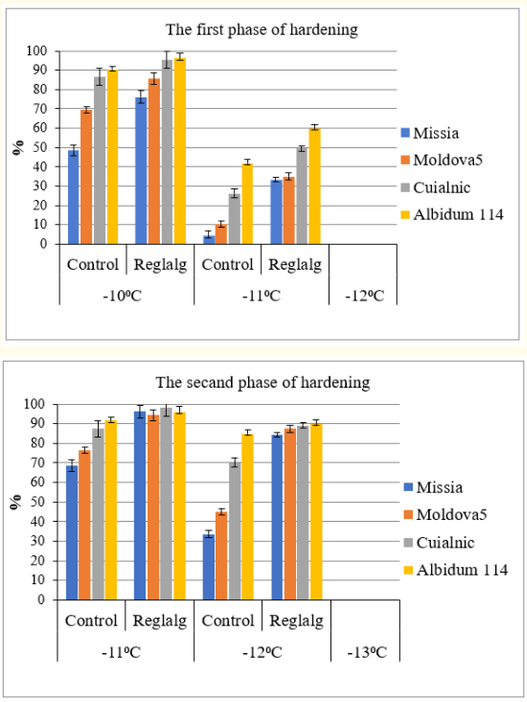

Figure 2: The initiation of secondary roots by the plants of wheat varieties Misia, Moldova 5, Cuialnic, and Albidum 114 obtained from the seeds treated before sowing with water (Control), or solution of the Reglalg (Reglalg), collected in the winter, and after the first and second phase of hardening exposed to the SNT during 8 hours (the temperatures indicated on the abscissa).

In the figure 3 are included the photographs of plants obtained from the seeds imbibed before sowing in water, or in solution of the preparation *Reglalg*. We can observe that the length of the epicotyl of experimental plants (obtained from seeds treated before sowing with the solution of *Reglalg*) in all genotypes was 1,0 -2,5 cm shorter compared with those of the plants from control variants. Due to this the secondary roots and tillering node of these plants are formed deeper and wetter layers of soil. In the winters without snow the soil temperature at the level of tillering node of experimental plants is expected to be 2-6°C higher [8] than that in the space of the tillering node of the control plants. This suggests that the beneficial effect of treating wheat seeds before sowing with the solution of biostimulant *Reglalg* is assured not only due to increased plants resistance to frost, but also due to avoiding the deleterious effects of winter frosts, droughts of spring and summer.

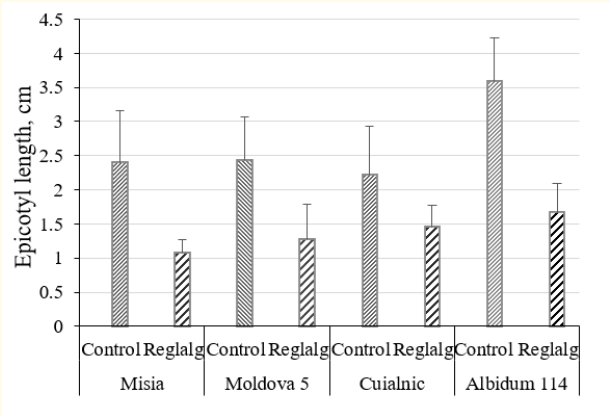

Figure 3: The average length of epicotyl of wheat varieties Misia, Moldova 5, Cuialnic and Albidum 114 plants obtained from the seeds that before sowing were treated with the water (Control), or the solution of biostimulator Reglalg (Reglalg).

The data about the influence of biostimulant *Reglalg* on the indexes of productivity of wheat varieties plants Misia, Moldova 5, and Cuialnic are included in the table. They indicate that the pre-sowing seeds treatment with the solution of the biostimulant *Reglalg* has positive, but statistically non-significant effect, on almost all indexes of productivity, which ultimately resulted in a statistically significant increasing the yield of all variety of wheat. Being more resistant to the extreme temperatures compared with the plants of control variants, the experimental plants were more vigorous and with extension of the vegetation period vegetation period by about 5 days. In the final, those mentioned, assured higher productivity of plants obtained from the seeds treated before sowing with biostimulant *Reglalg*. The above given data can be explained by the capacity of the plants from experimental variants to maintain their homeostasis at the higher level and in the extended intervals of environmental conditions [2].

Variety	Variants	Spikes per m^2	Grains per spikelet	Number of grain per spike	Weight of spike (g)	Weight of 1000 grains(g)	Grams per square meter
Moldova 5	Control	392 ± 25	2,78 ± 0,30	38,6 ± 11,0	2,39 ± 0,31	39,5 ± 4,0	598
	Reglalg	430 ± 22	2,82 ± 0,32	39,0 ± 12,1	2,43 ± 0,34	39,6 ± 4,1	**664**
Misia	Control	343 ± 19	2,90 ± 0,45	43,1 ± 11,0	3,09 ± 0,41	45,6 ± 4,5	674
	Reglalg	350 ± 21	2,98 ± 0,43	44,8 ± 11,4	3,19 ± 0,42	45,7 ± 4,9	**717**
Cuialnic	Control	366 ± 39	-	37,1 ± 1,6	2,00 ± 0,11	37,6 ± 0,4	511
	Reglalg	403 ± 45	-	38,0 ± 1,4	2,07 ± 0,14	37,8 ± 0,7	**579**

Table: The indexes of the productivity of wheat plants, varieties Moldova 5, Misia, and Cuialnic obtained from the control seeds and seeds treated before sowing with the solution of the biostimulant *Reglalg*.

Conclusion

- Treating the wheat seeds before sowing with the solution of the biostimulant *Reglalg* assure the increasing of their primary resistance to frost and, as well, improve the plants adaptation to winter frosts that in the end ensures the increasing the crop yield.
- In general, the complex and standardized composition of the biostimulant *Reglalg* ensures the induction in plants of specific biochemical processes which, in the case of imminent action of the stressors, are accelerating specific adaptations, thus contributing to the reduction of the stress-related damages and in final to increasing productivity, with lower costs for plants.

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