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THE USE OF SYSTEMIC APPROACH FOR OBTAINING AND PRACTICAL APPLICATION OF BIOSTIMULANTS IN AGRICULTURE

In the article are presents data on the frost resistance and productivity of different varieties of winter wheat plants, obtained from seeds treated before sowing with a solution of the biostimulant Reglalg, extracted from algae sp. Spirogyra. The obtained data confirmed the effectiveness of the system approach, implemented for optimization the methods of screening and practical use of this biostimulant in agriculture.

В статье представлены данные о морозостойкости и продуктивности растений различных сортов озимой пшеницы, полученных из семян, обработанных перед посевом раствором биостимулятора Reglalg, выделенного из водорослей рода Spirogyra. Полученные данные подтвердили эффективность системного подхода, реализованного для оптимизации методов скрининга и практического использования этого биостимулятора в сельском хозяйстве.

Key words: winter wheat; frost resistance; productivity; biostimulant *Reglalg*.

Ключевые слова: озимая пшеница; морозостойкость; урожайность; биостимулятор *Reglalg*.

Introduction

During the life cycle to survive after the actions of various unfavorable factors, the plants installed different evolutionary mechanisms of resistance to stress. Moreover, many of these mechanisms are relatively non-specific and they confer concomitantly resistance to different stressors [1]. Elucidating the common and specific features of plants' response to the action of different stressors is particularly important to optimize the procedures for screening and practical use of biostimulants in agriculture. Considering the complexity of the plants' response to the combined action of stressors and biostimulants, a rational way to increase the effectiveness of research in this field could be to use the principles of systems theory [1]. We present some of the results obtained by the use of the systemic theory methods in determining the biological activity and the implementation of biostimulant *Reglalg* [2] in agriculture.

Research methods

The research was performed in laboratory and field conditions, using different varieties of hexaploid wheat. Under laboratory conditions, the resistance of genotypes to different doses of the negative temperatures was appreciated, as well as the influence of the biostimulator *Reglalg* on the plants' response to extreme temperatures [3]. Under field conditions, the influence of the biostimulator on the plants' ontogenesis and productivity was determined.

Results and discussion

To appreciate the wheat genotypes resistance to negative temperatures, at the initial stage of germination (before the 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 at a specific temperature, during 8 hours. The results are presented on the fig.1. The data show that after exposure to *SNT*, at temperature -10^{o}C, the level of inhibition seeds germination of the varieties included in the research was diverse, the primary resistance of the Albidium 114 seeds being higher than that of the seeds of other three varieties. The germination percentage of seeds pre-treated with the solution of biostimulant *Reglalg* was about 20 % higher than of those pre-treated with water. Thus, the protective effect of biostimulant from exposition to *SNT* of seeds representing four winter wheat varieties was approximately the same.

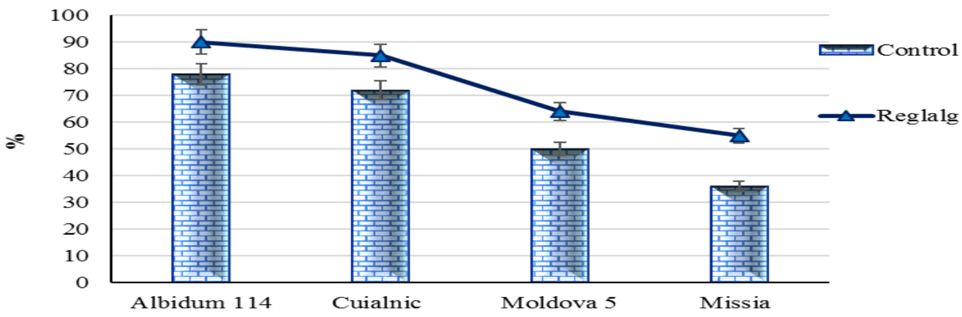

Fig.1. The percentage of wheat seeds germination, varieties Albidum 114, Kuialnic, Moldova 5, and Missia, which before application the *SNT*, at -10°C, were imbibed during 2 minutes in water (Control), or *Reglalg,* diluted with water in ratio 1 : 200 (*Reglalg*).

In the experiments provided in the field conditions were confirmed that plants of the variety Moldova 5 were more resistant to *SNT* than those of the variety Missia, Fig. 2. In the winter, after both phases of hardening, under the influence of *Reglalg*, the resistance of plants to the frost has grown significantly. Comparing the beneficial effect of *Reglalg* on the plants of both varieties, we can mention that increasing the plants' resistance to *SNT* of variety Missia was more pronounced in comparison with those of the variety Moldova 5. Thus, the beneficial effect of *Reglalg* was more pronounced on the plants of the variety that is less resistant to frost.

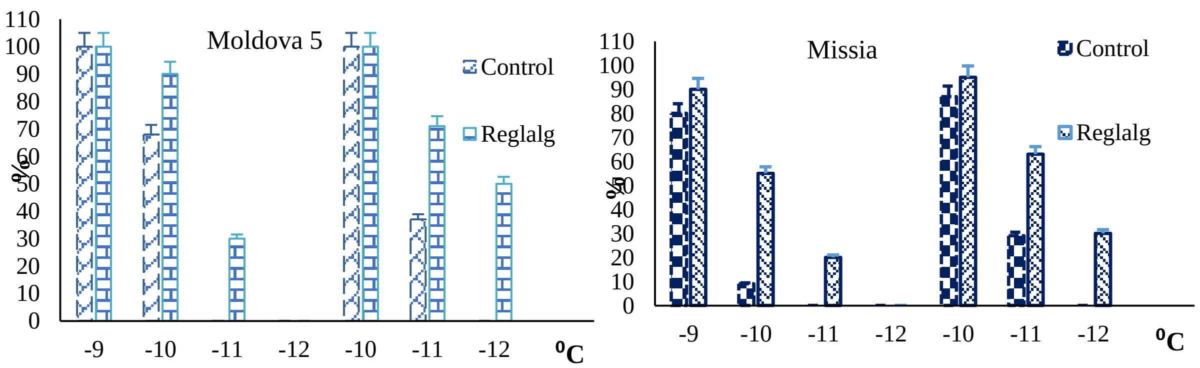

Fig.2. The initiation of coronary roots by the wheat plants, varieties Moldova 5 and Missia, obtained from seeds that before sowing was treated with water (Control), or solution of the *Reglalg* (Reglalg), and in the winter, after the first (left part of diagrams) and second (right part of diagrams) phase of hardening, were exposed to the *SNT*.

In the table are included data about the influence of biostimulant *Reglalg* on indexes of productivity of winter wheat varieties Moldova 5 and Missia plants. We mention that seed treatment before sowing with the biostimulant *Reglalg* has a positive, but statistically non-significant, effect on almost all of the indexes of productivity, which ultimately resulted in a statistically significant increase of the harvest. In the experimental groups, the harvest increased by 5.5 % (Missia variety) and 11.2 % (Moldova 5 variety). It remains to be determined whether the lower value of the percentage increase in productivity of Missia plants under the influence of *Reglalg*, compared to that of Moldova 5, was influenced by the higher "*cost*" allocated for adaptation to extreme temperatures by Missia plants, that are less resistant to extreme temperatures.

The indexes of productivity of wheat plants, varieties Moldova 5 and Missia, from the control seeds and the seeds treated before sowing with the solution of the preparation *Reglalg.*

Variety	Variants	Ears per m^2	Grains per spikelet	Number of grain per ear	Ear (g)	Weight of 1000 grains(g)	Quintals per ha
Moldova 5	Control	392± 2*5*	2,78±0,30	48,60 ±*11,0*	2,39±*0,31*	39,5±*4,0*	7.50
	Reglalg	430± *22*	2,82±0,32	49,00 ±*12,1*	2,43±*0,34*	39,6±*4,1*	**8.34**
Misia	Control	343±*19*	2,90±0,45	53,10 ±11,*0*	3,09±*0,41*	45,6±*4,5*	8.30
	Reglalg	350±*21*	2,98±0,43	54,80 ±*11,4*	3,19±*0,42*	45,7±*4,9*	**8.76**

Conclusions

1. Treating the wheat seeds before sowing with the solution of the biostimulant *Reglalg* lead to increasing the primary resistance of the plants and as well their capacity of adaptation to the winter frosts, what, in the end, ensures the increased crops yield.

2. In general, the complex and standardized composition of the biostimulant *Reglalg* ensures, under its influence on seeds, the initiation in the obtained plants of specific physiological processes which, in the case of imminent action of the stressors, accelerate the induction of non-specific and specific adaptations that contributes to the reduction of the stress-related damages and, in final, to increased plants' productivity.

3. As Reglalg regulates/modifies the physiological processes in plants, stimulate growth, mitigate stress-induced limitations, and increase yield, its proprieties correspond to the definition of biostimulants.

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