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### **INFLUENCE OF PRESEEDING TREATMENT OF SEEDS OF SCOTS PINE AND NORWAY SPRUCE ON THEIR VIABILITY AND ENERGY OF GERMINATION**

This work aims to study of the effectiveness of growth regulators for pre-emergence treatment of seeds (Scots pine and Norway spruce) and their influence on viability and energy of germination of seeds and establishment of optimum duration of soaking seeds in solutions of the preparation and identify their most effective concentrations in depending on tree species.

For this approach, we used preparations of Stimpo and Zircon. To study the efficiency of growth regulator Stimpo were prepared solutions with concentration of 1.5; 2.0; 2.5 ml/l the Samples of seeds, which were treated with different concentrations, were left on soaking for 8, 14 and 20 h. To study the action of the preparation Zircon prepared solutions with concentration of 0.5; 1.0; 1.5 ml/10 l. Seed soaking was carried out for 12, 24 and 36 h. Comparison of the effectiveness of growth regulators was carried out with the control of samples of seeds, which were soaked in water.

It is revealed that the best concentration for seeds of Norway spruce, which were treated with the preparation Stimpo is 2.0 ml/l with soaking time for 14 h, and for Zircon – 1.0 ml/10 l with soaking for 24 h. For seeds of Scots pine the best concentration when applying growth regulator, Stimpo is 2.5 ml/l when soaking time for 14 h, and Zircon – 1.5 ml/10 l with soaking time for 24 h.

**Key words:** growth regulator, energy of germination, viability, concentration.

**Introduction.** Now an important direction on improvement of qualitative composition of forests and on increase of their efficiency is the complex of actions connected with creation and effective utilization of constant forest trees seeds base on the breeding-genetic basis [1].

Thus, to increase the sowing seeds qualities and yield of a high-quality planting stock they pay special attention in nurseries to growth regulators of plants – natural and synthetic organic matters, capable to stimulate growth and development of plants. Thanks to nutrients, vitamins, minerals, hormones which are part of plant growth stimulants the necessary favorable conditions are created for seeds germination and further shoots growth, with the result that the soil germinating capacity raises, the shoots are more uniform, and the seeds germination period reduces.

According to the State register of plants protectors (pesticides) and fertilizers usable on the territory of the Republic of Belarus, the following growth regulators are approved for seeds treatment of coniferous species before sowing in our country: Peat Oxidat and Stimpo [2]. However there is also a considerable quantity of perspective growth regulators which were subjects of researches, but they were not included into the register. For such preparations the soaking time and solutions concentration were found out experimentally.

Our work supplements and enlarges already available data on the research results of usage efficiency of growth regulators and it contains recommendations on the optimum modes of their application.

**Main part.** For find out the influence of growth regulators on germination energy and germinating capacity of seeds of Scots pine and Norway spruce the preparations Stimpo and Zircon were used.

Zircon – is a natural plant growth stimulant, the reactant of which is a mixture of hydroxycinnamic acids received from a medical plant *Echinacea purpureum*, known for its immunomodulatory properties. The action spectrum of Zircon – is growth-regulating (with high rhizogenic activity and strongly pronounced function of seeds germination), immunomodulatory and antistress action. Zircon activates synthesis processes of chlorophyll, growth, plants rhizogenesis, compensates deficiency of natural growth regulators, and raises adaptable organism possibilities [3].

Stimpo (biological plants growth regulator) is a product of biotechnological cultivation of fungi-epiphytes on a ginseng root system. Phytohormones, amino acids, free fatty acids, oligosaccharides, chitosan and microelements (Zn, Cu, Mn, Mg, Ca, Fe, Na, K), vitamins, and also a bio-protection complex are included in the preparation composition. Besides, the preparation protects plants from phyto-nematodes and insects-phytophages, and also from phyto-pathogenic fungi [4].

Experiments were carried out in laboratory conditions by sprouting of seeds of Norway spruce and Scots pine on the seeds germinator of RUMED firm.

Seeds treatment was carried out by their soaking in water solutions of preparations with different concentration left for different periods of time. For Stimpo preparation study the following solution strengths were taken: 1.5; 2.0; 2.5 ml/l. Seeds samples were left for soaking for 8, 14, 20 h.

For Zircon preparation study the solutions with concentration 0.5; 1.0; 1.5 ml/10 l were prepared. Soaking time of each sample was 12, 24, 36 h.

According to STANDARD 13056.6-97 “Seeds of trees and bushes. Methods of determination of

germinating capacity” [5] for each experiment variant 4 samples of 100 seeds were taken. Sprouting was carried out at temperature of 24°C. Sprouts counting was done daily during 15 days. Germinating capacity was found out as the arithmetic mean value of sprouting results of individual seeds samples. Seeds soaked in wateract as control.

Seeds germinating energy of Norway spruce was determined on the 10<sup>th</sup> day of sprouting, of Scots pine – on the 7<sup>th</sup> day. Germinating capacity of seeds of two tree species was determined on the 15<sup>th</sup> day of sprouting.

According to the results of the data processing, received as a result of carrying out experiments, the best indices of the growth regulator Stimpo had the seeds samples of Norway spruce, treated by the solution with concentration of 2.0 ml/l, with soaking time of 14 h. The seeds germination graph is given in Fig. 1.

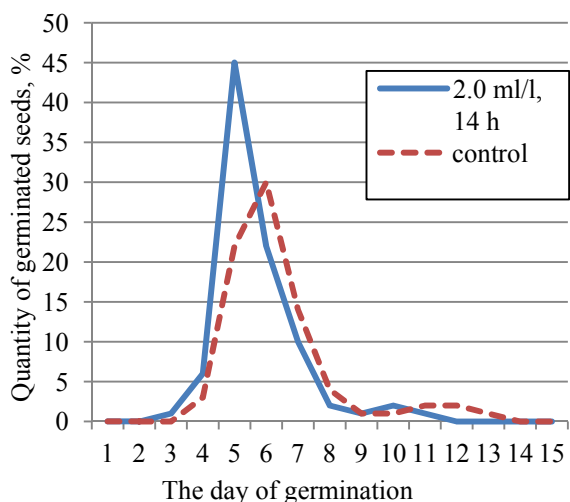


Fig. 1. Seeds germination graphs of Norway spruce of control samples and of samples treated by Stimpo preparation with concentration of 2.0 ml/l

Analysis of Fig. 2 showed that germination energy and germinating capacity of seeds of Scots pine exceed those of the control samples by 13 and 7% accordingly.

At the germination analysis of seeds treated by Zircon preparation, it was found out that the optimum solution strength for seeds of Norway spruce was 1.0 ml/10 l with the soaking time of 24 h. Seeds germination energy in this case exceeds the control sampled by 14%, and germinating capacity – by 13%. The seeds germination data are given in Fig. 3.

The best germination results of Scots pine seeds treated by the growth regulator Zircon were shown by the samples treated by the preparation with concentration of 1.5 ml/10 l, with the soaking time of 24 h. Germination energy and germinating capacity of seeds exceed the control samples by 9 and 7% accordingly.

In Fig. 4 there is the seeds germination graph of Scots pine, treated by the growth regulator Zircon.

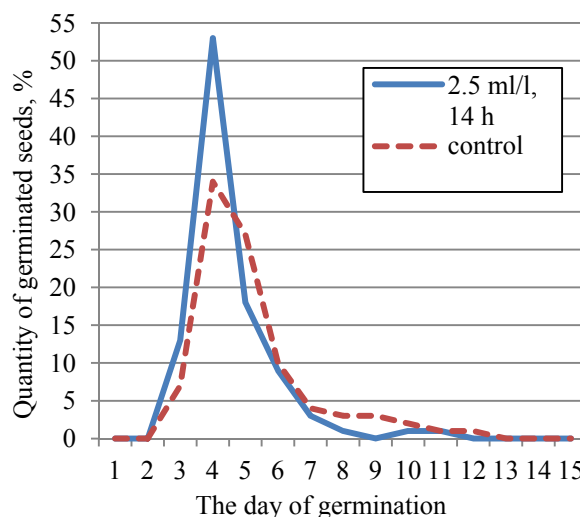


Fig. 2. Seeds germination graphs of Scots pine of control samples and of samples treated by Stimpo preparation with concentration of 2.5 ml/l

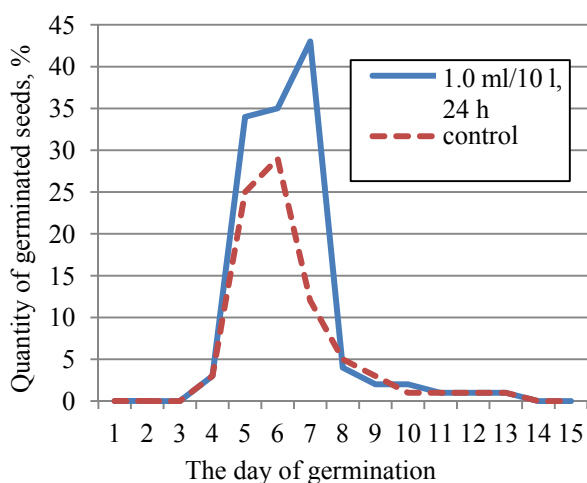


Fig. 3. Seeds germination graphs of Norway spruce of control samples and of samples treated by Zircon preparation with concentration of 1.0 ml/10 l

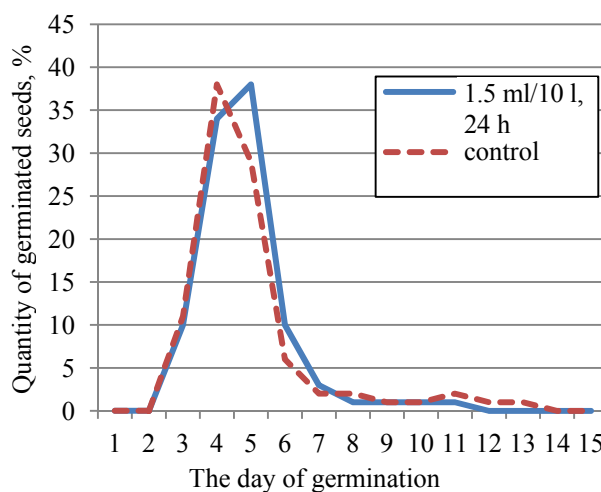


Fig. 4. Seeds germination graph of Scots pine of control samples and of samples treated by Zircon preparation with concentration of 1.5 ml/10 l

**Germination data of seeds of Norway spruce and Scots pine,  
treated by Stimpo and Zircon preparations**

Preparation	Solution concentration	Soaking time, h	Results registration days														
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Stimpo	2.5 ml/l	Data on Norway spruce															
		8	0	0	1	3	35	58	78	84	86	87	88	88	88	89	89
		14	0	0	1	7	48	73	83	85	86	86	87	87	87	87	87
		20	0	0	0	6	37	59	68	72	74	76	77	79	79	79	79
		Data on Scots pine															
		8	0	0	5	41	69	87	90	92	93	95	95	95	95	95	95
		14	0	0	13	66	84	92	95	96	96	97	98	98	98	98	98
		20	0	0	6	31	56	70	78	82	85	87	89	90	90	91	91
		Zircon	1.5 ml/10 l	Data on Norway spruce													
12	0			0	0	2	34	63	75	80	85	88	90	90	90	90	90
24	0			0	0	2	32	64	78	82	85	88	89	90	91	91	91
36	0			0	0	1	18	41	60	69	73	75	78	79	80	80	80
Data on Scots pine																	
12	0			0	6	28	57	72	80	85	89	92	95	96	96	97	97
24	0			0	10	44	81	91	95	96	97	97	98	98	99	99	99
36	0			0	5	28	56	69	77	80	82	84	86	87	87	87	87

In experiments with seeds treated by solutions with increased concentration and soaked during a long time, growth regulators manifest not stimulating, but inhibitory action. In the Table there are data on seeds sprouting of Scots pine and Norway spruce, treated by Stimpo preparation with concentration of 2.5 ml/l with soaking time of 20 h and by Zircon preparation with concentration of 1.5 ml/10 l with soaking time of 36 h.

According to the table data it is clear that at application of solutions with increased concentration and at a long seeds soaking time the germination energy decreases considerably. For spruce seeds at the usage of the growth regulator Stimpo

the difference is 11%, in experiments with Zircon preparation the difference is equal to 13%. For Scots pine seeds the difference is 17 and 18% accordingly.

In Fig. 5 there are comparison graphs of the optimum application modes of two preparations.

In Fig. 6 there are seeds germination graphs of Scots pine treated by growth regulators at the optimum modes of their usage.

Comparing these two growth regulators, it is possible to notice that in the variant with Stimpo the sprouting results in the first days of experiments have increased indices in comparison with the other preparation.

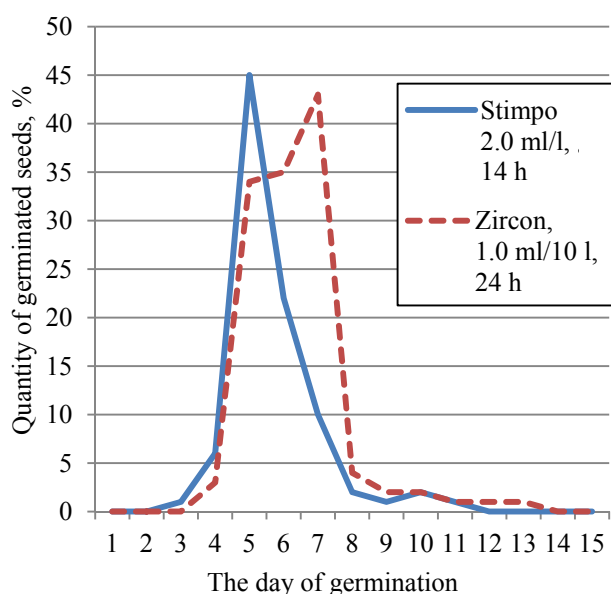


Fig. 5. Seeds germination graph of Norway spruce at the optimum application modes of Stimpo and Zircon preparations

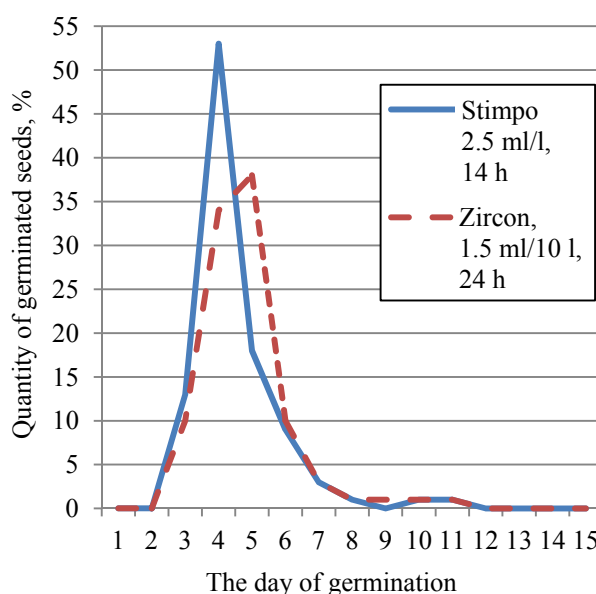


Fig. 6. Seeds germination graph of Scots pine at the optimum application modes of Stimpo and Zircon preparations

Mass germination of spruce seeds at application of Stimpol preparation is observed on the 5<sup>th</sup> day, and of pine seeds – on the 4<sup>th</sup> day, and for Zircon – on the 7<sup>th</sup> and 5<sup>th</sup> days accordingly. It is necessary to notice that spruce seeds treated by Stimpol, start to sprout already on the 3<sup>d</sup> day.

**Conclusion.** Usage of solutions of plant growth stimulants Stimpol and Zircon at seeds treatment of Scots pine and Norway spruce influences their germination positively.

For Norway spruce at application of Stimpol preparation the best concentration is 2.0 ml/l with the soaking time of 14 h, and at usage of Zircon preparation – 1.0 ml/10 l and 24 h accordingly. For Scots pine the best concentration at application of the growth regulator Stimpol is 2.5 ml/l with the soaking time of 14 h, and at Zircon usage – 1.5 ml/10 l and 24 h accordingly.

At seeds treatment with increased concentration and during a longer soaking time the growth regulators act as growth inhibitors, i. e. suppress the seeds germination process.

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