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SPECIFIC FEATURES OF THE GROWTH OF SCOTS PINE ORIGINATING FROM CONTROLLED CROSSING IN NEMANSKO-PREDPOLESSKY FOREST SITE AREA

In the given work we study the growth characteristics of hybrids pine ordinary in 1 to 3 years of age, resulting in a controlled crossing with various ecotypes. Found that the differences among hybrids in height were more pronounced in the 1-year old, and when the plants age of 3 years, there smoothing growth rate. Better control (40.8 cm) in 3-years of age are growing hybrids from crosses involving aimed ecotypes Estonia (58.8 cm) and Volyn (57.4 cm) of origin. In other cases crosses hybrids pine ordinary grow at or better than the control (41.6–51.6 cm), but the differences were not statistically significant.

Introduction. The provisions of the Strategic Forestry Development Plan of the Republic of Belarus regard breeding a new population of Scots pine with valuable properties by using controlled crossings of the checked parent forms as the priority direction for the nearest future [1].

Controlled intraspecific hybridization with the use of different climatic types of Scots pine is one of the methods promoting increase of efficiency, quality and stability of artificial plantings. Besides, crossing of various climatypes of Scots pine allows to receive valuable intraspecific hybrids with such outstanding features and characteristics as rapid growth and abundant fertility, straightness of a trunk, resistance to pests and diseases.

The directed pine hybridization provides an opportunity to combine abilities of different climatypes, which will as a result give a posterity with rapid growth, harrow-crowned, thin-twigged, with high resin productivity and other valuable features and characteristics [2].

In the opinion of V. F. Nikitenko and A. I. Sidor, which were engaged in artificial crossing of clones of different forms of a local Scots pine, the highest fertility of cones was observed among the clones that were strongly differing on generative organs [3].

In the researches on crossing of geographical ecotypes of Scots pine in the Voronezh region, V. N. Nenyukhin comes to a conclusion that the choice of a pollinator has essential impact on the growth and development of the posterity received from directed pollination. For example, as a result of pollination of a local pine by pollen of the Novgorod ecotype, there was received the posterity with the number of cotyledons twice exceeding the control, seedlings formed a crown bud 7–10 days earlier than others, and had short needles with a glaucescent shade. Average height of 1-year old seedlings significantly exceeded the given indicators of other variants of crossing. At the same time when there was used pollen of the Finnish ecotype hybrid seedlings had the cmallest height [4].

According to V. P. Demidenko and V. M. Urusov, 35-year old pines growing stock that was received as a result of hybridization could reach 250–280 m^3/hectare [5].

The purpose of this work is to study the growth features of posterity from controlled crossing of various ecotypes of Scots pine.

Main part. Researches on studying of growth features of posterity of Scots pine that was received as a result of controlled crossing using various ecotypes were carried out in 1-3-year old test cultures, created in Negorelsky experimental forestry station of Nemansko-Predpolessky forest site area. The history of creation of this object, the technique of pollination and the characteristic of pine test cultures were given by us earlier in the works [6, 7].

For the definition of growth indices of Scots pine hybrid posterity from controlled crossings, in each option 50 plants were measured. Height of plants was measured by a tape measure, needles length – by a ruler, diameter – by a beam compass.

The results of the analysis of the given data showed that the pine hybrid posterity, which was received from controlled crossings using a number of ecotypes, differed in growth indices in identical conditions of habitat (see Table).

At one-year age the distinction by variants of crossing among the received posterity was more evident in comparison with plants at 3-year age.

With a participation of a clone 21/252 in crossing, the greatest height of 1-year old plants was observed in variants of Estonian and Minsk pollinators: 6.1 and 5.7 cm accordingly.

At pollination by pollens of Pskov, Orenburg, Leningrad, Khmelnytsky and Volynsk ecotypes the height of plants was lower than the control (posterity of a clone 21/252 from free pollination).

When clone 29/651 was involved in the crossing, one-year old plants were characterized by better growth if pollinated by local pollen. The height of plants equaled 6.1 cm.

Hybrids better than the control (posterity of a clone 29/651 from free pollination) were received if there was used pollination by Estonian pollen (6.0 cm), Khmelnytsky (5.9 cm) and Volynsk (5.7 cm) ecotypes. The pine posterity from pollination by pollen Orenburg (4.9 cm), Leningrad (4.7 cm) and Mariel (4.4 cm) ecotypes grew worse than the control.

Growth indices of Scots pine posterity received as a result of controlled crossings

Crossings variant	Age, year	Parameters					
		Trunk height, cm	*t*-criterion	Root neck diameter, mm	*t*-criterion	Needle lenght, cm	*t*-criterion
♀21/252 × ♂Volinsky	1	**4.5 ± 0.2**	4.58	1.2 ± 0.1	0.71	2.7 ± 0.1	0.70
	3	37.2 ± 1.2	1.25	6.4 ± 0.2	1.66	6.9 ± 0.1	1.72
♀21/252 × ♂Chmelnizky	1	**4.7 ± 0.2**	3.44	1.3 ± 0.1	0.00	2.8 ± 0.1	0.00
	3	34.8 ± 1.5	1.49	8.0 ± 0.2	0.45	**8.2 ± 0.5**	2.89
♀21/252 × ♂Poskovsky	1	**5.0 ± 0.2**	2.35	1.3 ± 0.1	0.00	2.8 ± 0.1	0.00
	3	43.6 ± 1.1	0.57	8.8 ± 0.1	0.15	**8.5 ± 0.2**	3.74
♀21/252 × ♂Orenburgsky	1	**4.9 ± 0.2**	2.61	1.3 ± 0.1	0.00	**3.2 ± 0.1**	3.51
	3	41.8 ± 1.4	0.76	7.8 ± 0.2	0.60	6.6 ± 0.1	1.32
♀21/252 × ♂Leningradsky	1	**4.7 ± 0.1**	4.69	1.3 ± 0.1	0.00	2.6 ± 0.1	1.67
	3	36.2 ± 1.5	1.35	7.9 ± 0.1	0.53	5.9 ± 0.1	0.40
♀21/252 × ♂Estonsky	1	**6.1 ± 0.2**	2.15	1.4 ± 0.1	0.71	2.8 ± 0.1	0.00
	3	48.4 ± 1.6	0.06	11.0 ± 0.2	1.81	**7.4 ± 0.2**	2.32
♀21/252 × ♂Minsky	1	5.7 ± 0.2	0.35	1.3 ± 0.1	0.00	2.9 ± 0.1	0.79
	3	51.2 ± 2.0	0.23	**12.8 ± 0.7**	2.83	6.8 ± 0.2	1.55
21/252 (control)	1	5.6 ± 0.2	–	1.3 ± 0.1	–	2.8 ± 0.1	–
	3	49.0 ± 1.8		8.6 ± 0.2		5.6 ± 0.1	
♀29/651 × ♂Volinsky	1	5.7 ± 0.3	1.06	1.2 ± 0.1	0.00	2.7 ± 0.1	0.00
	3	**57.4 ± 2.2**	2.04	**12.2 ± 0.6**	2.53	8.2 ± 0.4	1.18
♀29/651 × ♂Orenburgsky	1	**4.9 ± 0.2**	2.43	1.1 ± 0.1	0.71	2.6 ± 0.1	0.77
	3	46.4 ± 1.5	0.70	9.6 ± 0.3	1.01	6.8 ± 0.2	0.35
♀29/651 × ♂Marielsky	1	**4.4 ± 0.3**	3.57	1.2 ± 0.1	0.00	2.9 ± 0.1	1.54
	3	42.6 ± 1.7	0.22	8.0 ± 0.2	0.00	6.0 ± 0.1	1.30
♀29/651 × ♂Estonsky	1	**6.0 ± 0.2**	2.91	1.3 ± 0.1	0.71	2.8 ± 0.1	0.83
	3	**58.8 ± 1.2**	2.27	**13.6 ± 0.3**	3.55	8.8 ± 0.3	1.90
♀29/651 × ♂Minsky	1	**6.1 ± 0.2**	3.11	1.3 ± 0.1	0.71	**3.1 ± 0.1**	3.58
	3	51.6 ± 1.3	1.36	**12.0 ± 0.3**	2.53	7.9 ± 0.2	0.92
♀29/651 × ♂Chmelnizsky	1	5.9 ± 0.2	1.58	1.2 ± 0.1	0.00	2.8 ± 0.1	0.89
	3	46.2 ± 1.8	0.67	**11.2 ± 0.5**	1.97	7.8 ± 0.2	0.81
♀29/651 × ♂Leningradsky	1	**4.7 ± 0.2**	4.12	1.0 ± 0.1	1.41	2.5 ± 0.1	1.54
	3	42.4 ± 1.6	0.20	9.5 ± 0.3	0.95	5.8 ± 0.2	1.50
♀29/651 × ♂Pskovsky	1	**5.0 ± 0.1**	2.78	1.1 ± 0.1	0.71	2.8 ± 0.1	0.97
	3	41.6 ± 1.9	0.11	10.1 ± 0.8	1.20	6.7 ± 0.2	0.46
29/651 (control)	1	5.4 ± 0.1	–	1.2 ± 0.1	–	2.7 ± 0.1	–
	3	40.8 ± 1.5		8.0 ± 0.3		7.1 ± 0.1	

Notes: 1. The seed posterity that originated from the seeds of clones 21/252 and 29/651 of forest seed plantation of the first generation Uzdensky forestry station was taken as a control to compare growth indices.

2. The indicators of values that are significantly different from the control variant (the standard value of Student's coefficient is $t_{0.05} = 1.96$) are highlighted by bold-face type.

At 3-year age the distinction on growth indices among pine hybrids by variants of crossings cmoothed out. With participation in crossing as a maternal form of a clone 21/252, the posterity from pollination by pollen of the Minsk ecotype (51.2 cm) grew better than the control (49.0 cm), however the excess was insignificant.

In others variants of crossing with participation of a clone 21/252, pine hybrids grew at the level with the control or had smaller height, but the difference was insignificant.

The crossing of different ecotypes of Scots pine with a clone 29/651 shows that the received hybrids considerably differ from the control in height. The greatest height of trees is noticed when using the posterities received from directed crossings with use of Estonian and Volynsk ecotypes as pollinators – 58.8 and 57.4 cm accordingly (distinctions in comparison with the control were significant).

In others variants of crossing hybrids have height exceeding the control, but significant difference wasn't confirmed.

Conclusion. The conducted researches of test cultures of Scots pine that were received from controlled crossing using different ecotypes confirm the presence of distinctions in growth.

In such a case growth distinctions of hybrids were more evident at one-year age, and by the age of 3 years the height difference gradually have cmoothed out. The hybrids from the directed crossings with participation of pollinators of Estonian and Volynsk ecotypes grow better than the control at 3-year age.

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