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Analysis of the preservation and growth of scots pine in the provenance trials of professor Vasily Ogievsky in educational-experimental forestry

Yu I Danilov*, M Ye Guzyuk, A A Fetisova, M A Nikolaeva

Department of Soil Science and Forestry, Institute of Forest and Natural Resources Management, *Saint-Petersburg State Forest Technical University*, 5 Institutsky per., Street, Petersburg 194021, Russian Federation

*E-mail: leskultur@mail.ru

Abstract. Results of 100 years' tests of posterities of 16 climatic types of a pine in the geographical forest cultures put in 1913 in Okhtensky forestry under the leadership of professor of Imperial Lesnaya of institute Vasily Ogievsky are presented. Now the average safety of forest cultures is 6.5%. The lowest safety (3%) has noted posterity from the Perm province; the best safety (9-11%), along with Olonets (considered as local), posterities from the central regions of the country – the Oryol and Moscow provinces have. The most successful growth characterizes the southern and southwest posterities. Volynsk and Lublin (on average height – 30.4-30.5 m) and Lomza (on average diameter – 36.5 cm) are distinguished from them. The Olonets posterity, despite less successful growth in comparison with the southern and southwest races, doesn't concede to them on a reserve of stem wood (510 m³ ha against 275-507 m³ ha). It is established that the geographical origin of seeds is of great importance in the creation of forest cultures. Depending on remoteness of places of preparations of seeds in the direction from the North on the South parameters of growth of the created cultures are higher, but the safety of cultures gradually decreases. The preservation and growth of forest cultures are worse as far as the removal of the seeds from the area of its testing to the East.

1. Introduction

At transfer of forest seed farming to a genetic-selection basis it is important to use rationally a gene pool of natural populations of tree species. Application of population selection taking into account the geographic variability of tree species will allow to increase efficiency of our woods. The most effective method of studying of geographical variability is creation and studying of geographical cultures in a number of generations [1, 2]. The relevance of research in the study of the main forest-forming species geographical variability is emphasized at the level of the International Union of Forest Research Organizations (IUFRO) [3, 4], as well as determined by the Convention on Biological Diversity.

One of the oldest pine geographical cultures in Russia are series of cultures put under the leadership of Vasily Ogievsky in 1910-1916 in Russian forest areas. The most studied object from this series are the cultures created in quarter 8 of Okhta educational-experimental forestry in 1913 which materials by results of researches were earlier repeatedly published [5].

The area intended under cultures represented cutting of 1910 from under a pine forest stand of the II-III classes of site class. Processing of the soil has been carried out in 1913 by preparation of seats of 40×40 cm in size with placement 1.42×1.06 m that corresponded to density of landing of 6600



pieces/hectare. The area has been broken into 5 sites with intervals between them on 4.5 m. On each site about 28 rows landed; landing by 1-year seedlings was made under V Kapper's observation.

The purpose of this work is to conduct comparative silvicultural research of prof. Vasily Ogievsky 102-year-old pine-tree cultures. Field data collection was carried out in accordance with the Forest Seed Guidelines [6]. In all of the 16 variants, the diameter of the trunks was measured in all trees with a measuring fork. The height was determined at each site in 15-20 trees with an altimeter. In the following determination of trunks volumes and timber stocks values was carried out. The safety of cultures was established as the ratio of the remaining trunks to the number of this climatype initially planted seedlings. Cultures were being investigated regularly throughout the 102-year period. Therefore, the results of previous studies allowed us to estimate the cultural growth dynamics in individual taxation indicators.

2. Experimental Part

Posterities of 16 climatype (geographical races) origin from various provinces of northern, central, southern, southwest and east parts of Russia were subject to tests.

For obtaining comparable data when studying cultures the technique similar to the previous researches was applied. On each of 16 options it is executed continuous recouples of trees with determination of safety and parameters of growth with the subsequent determination of volumes of trunks and reserves of wood.

It should be noted that some external factors have exerted impact on growth of cultures. So, the fifth site (The Tambov race) has suffered from the fire in 1920, and the first (The Vladimir, Moscow races) – has been partially broken at plane crash in Patriotic war. Besides, some options of experience are presented by small number of individuals, thinning strongly and, growing in extreme ranks from a gap, have a little evaded from normal development. The specified moments need to be considered in the analysis of the received material. However, in general skilled culture has remained rather well and is of great value.

3. Results and Discussion

Comparative assessment of dynamics of safety of cultures shows that at early stages of development (in 4-year cultures) sharp falling of safety in the southern posterities was noted. Keletsky and Kiev posterities had safety less than 40%. The considerable smasher proceeding to 7-8-year age was observed at pines of the southern and southwest races which safety by the end of the first 10 anniversary didn't exceed 20% (Figure 1).

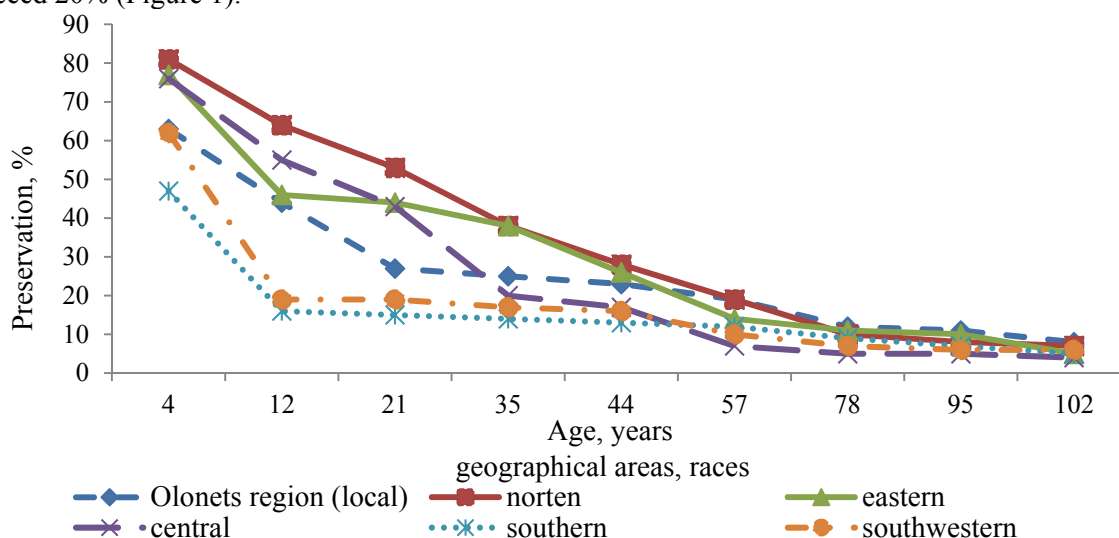


Figure 1. Dynamics of safety of cultures of a pine on geographical areas.

At 12-year age the best safety (81-87%) characterized posterities of northern, northeast and central races, in particular, Vologda, Vyatka, Vladimir, Moscow. Up to 40-50-year age these posterities continued to keep the status of the best on safety. In the coming and ripe plantings the best safety is noted in posterities of northern and northeast races, the worst – at posterities of the central race.

In 102-year cultures have the increased safety (9-11%), along with Olonets (local) posterity, Moscow and Oryol; the safety less than 5% characterizes posterities: extremely east – Perm, southern and southwest – Kiev, Lomza, Keletsk.

Growth of cultures both on height, and on diameter, in the first 10 years was characterized by weak dependence on geographical origin of seeds; however the tendency was traced: with removal from the area of test of places of preparations of seeds on the South and the southwest parameters of growth of cultures were higher.

Posterities of the southern and southwest origins have been carried to the II class of age to undersized (6.1-6.3 m) (Volynsk, Kiev, Lublin, sedletsky, Grodno); high pines (7.5-7.7 m) were observed in posterities from east (Vyatka) and central (Oryol, Moscow, Vladimir) areas. Average thickness of trunks, irrespective of origin of posterities, varied in narrow limits – 5.9-6.4 cm; at the same time the lomzhinsky option (7.5 cm) which has still kept the leadership (Figures 2 and 3) was allocated.

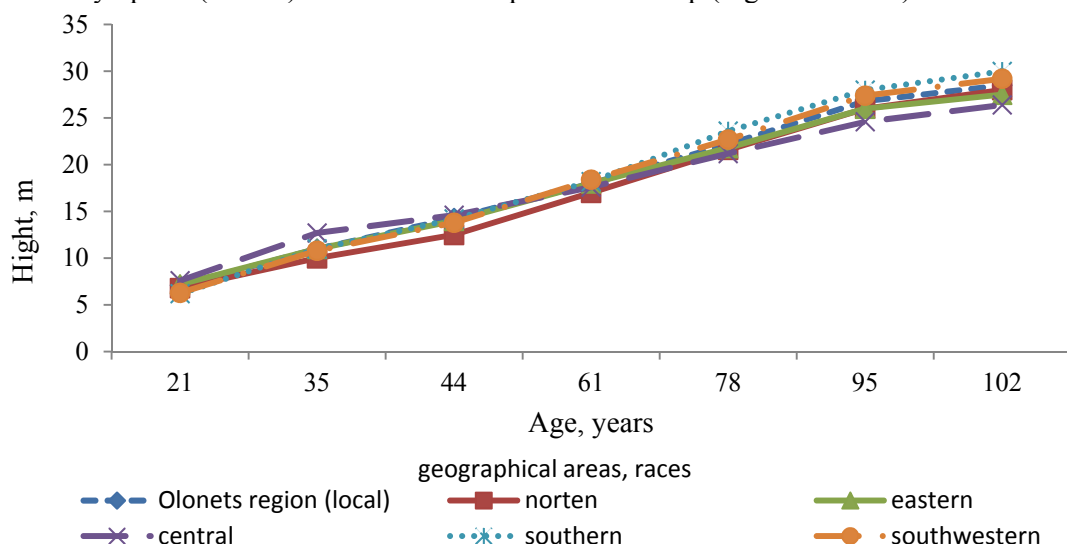


Figure 2. Dynamics of growth of cultures of a pine on height on geographical areas.

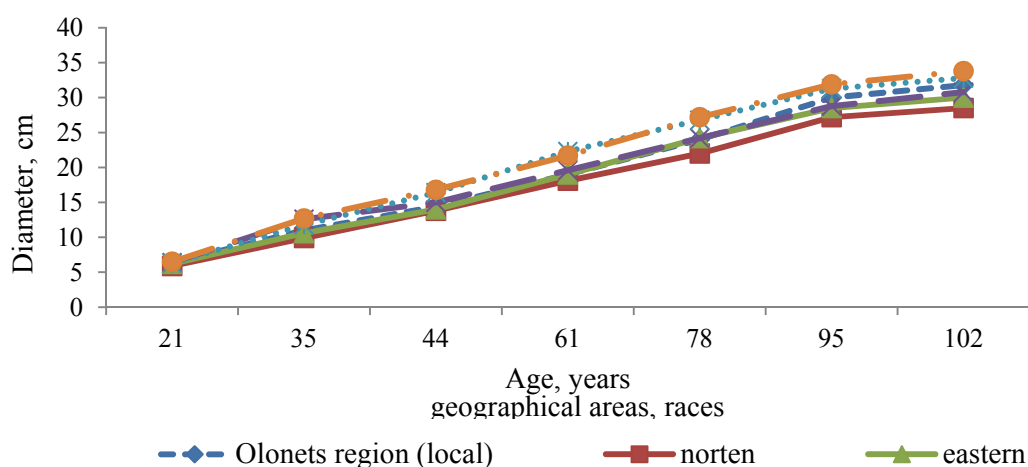


Figure 3. Dynamics of growth of cultures of a pine on diameter on geographical areas.

From 40-year age and till present posterity of the southern and southwest races grow on diameter most successfully; in too time, growth on diameter of posterity of a northern climatype decreases; in 100-year cultures this option is the most thin.

M Branovitsky [7] researches have established connection between average values of diameters of trees of separate geographical options and density of forest stands: diameters of trunks in more dense pine forests of northern origin have appeared less, than in pine forests of the southern and southwest origins.

The 100-year geographical cultures of a pine are characterized by the most expressed differentiation of parameters of growth depending on geographical origin of seeds. Northern and east posterities grow more slowly, than southern and southwest; the Olonets posterity taken for control it takes an intermediate position on growth, but on safety and a reserve of wood among best (Table 1.). The Vologda and Olonets posterities considerably differ from posterities of the southern and central races in the straight trunk; in too time, in posterities of the southern and southwest areas the bough is brightly expressed.

Table 1. Taxation characteristic of the 102-year geographical cultures of a pine put under the leadership of the prof. Vasili Ogiyevsky in Okhta educational-experimental forestry

Seed origin		Average growth height H, m	parameters of diameter $D_{1.3}, cm$	Trunk volume V, m^3	Quantity of trees, pieces ha	Stock $M, m^3 ha$
Region	Former guberniya					
Northern	<i>Olonets</i> ^a	28.5	30.8	0.928	550	510
	Vologda	28.0	28.5	0.842	460	387
Central	Oryol	26.0	31.0	0.869	720	625
	Moscow	26.0	30.5	0.841	525	442
	Vladimir	25.4	30.0	0.796	390	310
	Tambov	28.0	31.5	0.956	490	468
	Volynsk	30.5	31.6	1.057	480	507
Southern	Kiev	29.5	34.0	1.148	240	275
	Grodno	30.0	33.4	1.144	409	468
Southwest and Poland	Lublin	30.4	33.2	1.088	402	437
	Sedletsk	29.2	32.0	1.028	422	433
	Lomza	29.0	36.5	1.317	360	474
	Plock and Keletsk	26.8	29.5	0.808	Total trees are 8	
Eastern	Vyatka	28.0	30.5	0.897	450	403
	Perm	27.0	29.4	0.808	170	137

^a Olonets posterity - control option (local)

Analysis of dynamics of safety and growth of geographical cultures of a pine of the prof. Vasili Ogiyevsky has shown that the geographical origin of seeds is of great importance for silvicultural practice. In cultures the age variability of rank provision of posterities of climatype was observed that is manifestation of hereditary features of a genotype; between geographical areas (races) from early age influence of factors of origin which only amplifies over time is tracked. It is established that with removal of places of preparations of seeds on the South and the East the safety of cultures around test decreases, with removal on the South and the southwest – growth of cultures increases, but the quality of a trunk is lower that is confirmed by results of studying of geographical cultures of a pine on the VNIILM program [8-10]. Studying of geographical cultures of a pine in the countries of Scandinavia confirms that posterities from seeds of northern climatype grow more slowly, but they are steadier against adverse climatic factors and have a bigger share of qualitative trunks. On the contrary, plantings from seeds of the southern climatype grow and thinning quicker and have the worst form of trunks [11-14].

4. Conclusion

The geographical origin of seeds is of great importance for silvicultural practices. Over 100 years of growth, variability of the climatype rank generation was noted. The removal of seed collection sites to the south and east reduces the safety of forest cultures, and with removal to the south and south-west, forest cultures growth is improving. The prosperity of northern climatypes seeds grows more slowly, but characterized by a good shape of trunks. Southern climatypes have a high growth rate, but form curved trunks.

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