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S. S. Shtukin¹, P. I. Volovich², A. S. Klysh¹¹Belarusian State Technological University²Institute of Forest of the National Academy of Sciences of Belarus**SAFETY AND EFFICIENCY OF POLISH LARCH FOREST CULTURES
CREATED ON THE UPROOTED GLADE**

The paper presents the results of research of safety and productivity of 25-year-old Polish larch forest plantations established on the uprooted glade. Found that this species has a high energy growth at a young age. Pine forest cultures in similar site conditions are growing on I bonitet class. Polish larch in many biometric performances is greater than pine ordinary. Its average height is 1.4 times the average diameter 2.4 times higher than that of a pine forest cultures. Average larch trunk volume exceeds the benchmark by 7.2 times. Polish larch in 25 years is not inferior to the stock of pine ordinary. At the same time the density of pine plantations 7.2 times higher. Large stock of wood in the stand of Polish larch in 25 years is 37 m³/ha, and the number average particle size of timber higher than the target 11 times. Taxes cost of larch wood above the set four times. Stump extraction on the cutting helped to increase the safety of the Polish larch seven times.

Key words: Polish larch, forest cultures, trunk volume, pine ordinary, average height, average diameter.

Introduction. The most important tasks of forestry of Belarus are improvement of species composition of forests, increasing their productivity and strengthening of environment forming, water protective, protective, sanitary-hygienic functions, ensuring rational use of lands of state forest fund and conservation of genetic fund and biological diversity [1, 2]. One of the ways of solving these problems is the cultivation of fast-growing species that under natural conditions of our country do not grow naturally, but can form a highly productive forest plantation with increased resistance to increasing negative anthropogenic impact on forest ecosystems.

Main part. In the case of Belarus deserves the attention of the growing of European larch (*Larix decidua* Mill.), and especially its rare endemic Carpathian subspecies – the Polish larch (*L. decidua* Mill. subsp. *Polonica* (Racib) Domin) [3, 4]. The Polish larch and European larch in many ways are similar but have significant differences. Cones of larch Polish are much smaller (1.2 to 1.5 cm), and branches are directed more upwards. However, the most important advantage of Polish larch is that in contrast to the European larch it grows naturally not in mountains but in the plains and therefore its barrel does not have a sabre-like form that is very important for the quality of the wood.

It is known that the productivity of larch is superior to local forest-forming conifers and has a good purity of the trunk from the branches, solid-volume ratio and high proportion of timber output. Larch stands are durable and resistant to pests and diseases, they give high-quality wood, and they bind huge amounts of carbon and enhance soil fertility [3, 4]. Larch wood is characterized by strength, ability to be well preserved in water and earth, hardness, high resistance to compression and

to bending, and stability against alkalis and acids. These qualities contribute to the wide use of larch in the manufacture of important parts and the construction of buildings, manufacture of railway sleepers, timber production and other purposes [3].

In addition, the larch is resistant to low temperatures, fungal diseases and damage by insects. Due to the annual change of needles it is more resistant to industrial emissions than pine and spruce. Its litter, unlike the litter of other conifers, contributes to the improvement of soil fertility that in forest conditions of Belarus is particularly important [3].

In our country in the postwar years large-scale attempt to create forest plantations of exotic species, including larch has already been done. By 1973 about 12,000 ha of forest plantations of this kind had been created [4]. European larch and Siberian larch were cultivated. However, due to the lack of developed scientific-recommendations for the management of the economy in larch forests a significant portion of these plantations perished. This is evidenced by the data given by N. K. Kruck, etc. [4], according to which in our Republic only 370 ha of plantations of larch survived, and the absolute majority (280 ha) in composition with other species. It is noteworthy that 70% of these plantations are located in the woods of Vitebsk SFPA.

The main reasons for the low safety of forest cultures of larch have not been identified yet. Probably, mass mortality of created forest crops is connected with the imperfection of the organization of silvicultural production, and also technologies of creation and cultivation of plantations of this breed. Besides, in Belarus Siberian larch was mainly cultivated, which in natural conditions of Belarus do not always give positive results [4].

The development of scientifically grounded system of measures on the cultivation of larch has now become of particular importance in connection with climate change and periodic mass drying of spruce stands. In these circumstances, the need of at least partial replacement of spruce by other, more sustainable species is obvious. Not by chance in the field of seed selection the establishment of seed orchards of European and Polish larch first of all is provided, and the task of increasing the area of plantations of these tree species in 50 and more times is set before the Ministry of forestry of our country [4].

The Polish larch is most often classified as a subspecies of European larch [6]. Morphologically it differs from the European and is more like the Siberian larch. The contradictions of researchers in determining taxonomic grade of Polish larch are not random. So it is extremely important to pay attention to morphological features of Polish larch, noted by the researchers who have studied this woody plant [4].

Researches of productivity of Polish larch were carried out by us in Dvinsky experimental wood base of Institute of wood of NAS of Belarus. These plantings were established in spring 1989 at epy cutting with the number of stumps of 500 PCs./ha in 1 planning quarter Psuevskoye division of forestry, where the spruce was produced earlier (forest type – spruce fern, type forest growth conditions – B₂). As a result of the study of the granulometric composition of the soil it was found that the amount of physical clay in the A₁ horizon is 17.2%. In mechanical composition the soil on

the object is a fresh sandy loam. The area of the object is 2.4 ha. The area of experimental crops of larch on the grubbed out area of felling is 1.8 ha.

The plantation was founded 3 years by selection seedlings of Polish larch, brought from Latvia from the well known breeder, Dr. biological sciences V. M. Rone. Experienced silviculture of the Polish larch were laid in two versions. The first version – forest plantations of Polish larch, created on the grubbed out with wide strips cutting. Row spacing in forest cultures is 4 m, the distance between trees in a row is 3 m. The second version – forest plantations of Polish larch, created on the ungrubbed out cutting with the same placement of cultivated woody plants in the area. As it can be seen, the density of planting seedlings of larch in the area is quite low (0.83 thousand PCs./ha). This density of planting of forest crops was adopted due to the fact that they brought seedlings 3-year old has already been of 0.5–0.7 m high.

Widestripe uprooting of felling was applied for the purpose of enhancing the security of cultivated woody plants. Uprooting of the stumps on felling was produced in the fall of 1988 with the stubbing machine MP-2B in the unit with the tractor T-130, the processing of soil in all areas was done by plough PKL-70. As a control, the data of the tables of growth of pine forest stands of site class I, as with the pine fern the site class I is predominant (I. D. Yurkevich, 1980). In 1996 and 2003 cutting care were carried in the forest stands.

Researches performed in 25 year old plantations of Polish larch showed that this breed has a high energy of growth just at a young age (Table).

Silvicultural-taxation characteristics of the stand of Polish larch on the grubbed out cutting

Silvicultural-taxation indicator	Indicator of growth		
	Control (pine on the tables of growth)	Larch cutting down on the area grubbed out	Percentage to control
Age, years	25	25	–
Forest type	Pine	Larch	–
The type of forest site conditions	B ₂	B ₂	–
Density, thousand barrels per 1 ha	3,270	453	14
Average height, m	12.5	18.1	145
The quality	I	I ^b	–
The average diameter, cm	11.2	25.4	227
The sum of the areas of cross section, m ²	30.8	22.9	74
Completeness	1.0	0.7	70
Supply, m ³ /ha	206	195	95
Including: large wood	–	36.9	–
medium wood	11.1	120.8	1,088
small wood	86.2	27.2	32
firewood	7.6	5.0	66
Felling cost of timber, bel. rub.	5,434,053	21,660,471	399
The average stem volume, m ³	0.06	0.43	717

In research we found that the larch forest is currently growing by I^b quality class. Silviculture of Scots pine in similar forest conditions grow on the class I (less than I^a class). It should be noted that forest plantations of Polish larch created on ungrubbed cutting, have a very low preservation. Thus, the number of surviving woody plants on these sites is only 127 PCs./ha or 15% of the number planted, while in the grubbed out felling this figure is four times higher – 55%.

Analyzing the data, it should be noted that the Polish larch on many biometric indicators is significantly superior to pine in similar forest conditions. Its average height is 1.4 times, and the average diameter is 2.4 times greater than the rate in the forestry plantations of pines.

The average volume of trunk of larch is 7.2 times higher than that of pine. A supply of Polish larch at the age of 25 practically is not inferior to pine wood, which by the density of trees exceeds it 7.2 times.

In the stand of Polish larch the assortment structure is dramatically improved. Thus, the amount of large wood just at the age of 25 years is 37 m³/ha, and the number of average particle size wood 11 times exceeds the test indicator. The cost of felling of larch wood is 4 times above the test one. Uprooting of the stumps on felling increases the safety of the Polish larch 7 times.

Conclusion. Founded in the spring of 1989 experienced cultures of Polish larch in the ungrubbed and grubbed fellings in square 1 Psuevskoye forestry of the Dvinsky experimental wood base of Institute of wood of NAS of Belarus, are still unique in our country and represent a significant economic and scientific value. The performed study strongly suggests that the Polish larch, yielding to 25 years old pine on density of standing trees in 7.2 times, do not inferior for productivity. The cultivation of Polish larch allows significantly earlier to grow large-sized timber, with many extremely valuable properties. In 25 years, the average diameter of stands of larch reaches 25.4 cm. So the Polish larch is a promising woody plant for the plantation forestry. In commercial forests, such as forest plantations, such diameter may be convincing grounds for the immediate carrying out of the main felling.

As for the low safety of larch, especially on the ungrubbed cutting, it should be emphasized that for the rich and the relatively rich soils this “disease” is typical and for the other, especially light-demanding, species. For the radical change in long-standing negative situation, it is necessary radically to improve the applied system of accounting, control, quality assessment and promotion of activities in the development of forests of the natural and artificial origin.

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Information about the authors

Shtukin Sergey Sergeevich – D. Sc. Agriculture, professor, Department of Forestry. Belarusian State Technological University (13a, Sverdlova str., 220006, Minsk, Republic of Belarus).

Volovich Petr Ignat'evich – Ph. D. Agriculture, assistant professor, head of the reforestation section. Institute of Forest of the National Academy of Sciences of Belarus (71, Proletarskaya str., 246654, Gomel, Republic of Belarus). E-mail: elenavsanovagomel@mail.ru

Klysh Andrey Sergeevich – Ph. D. Agriculture, senior lecturer, Department of Forestry. Belarusian State Technological University (13a, Sverdlova str., 220006, Minsk, Republic of Belarus). E-mail: klysh@belstu.by

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