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THE GROWTH CHARACTERISTICS OF YOUNG STANDS OF EUROPEAN LARCH OF ARTIFICIAL ORIGIN DEPENDING ON SOIL CONDITIONS

The results of studies of forest cultures of European larch under the age of 10 years, pure and mixed in composition and grown in different soil conditions. The data on the safety and efficiency of the studied plants. The regularities of the nature of growth in height and diameter, the productivity of plants depending on soil conditions. The analysis of the growth conditions of forest cultures and peculiarities of formation of the soil profile in different forest types. It was found that the relationship between the growing conditions and productivity of plantations can be traced by comparing the content of physical clay in the upper horizons and planting stock. Also has a positive effect on the moisture content and availability of nutrients in the soil profile of the underlying moraine loam. The results of the chemical properties of soil horizons. Analysis of the chemical properties of the soil when growing on them European larch showed features of formation of humus horizon and acidic soil regime, which has a relatively high value in the upper horizons, and depth, this figure is reduced. Also traced the relationship between security and productivity batteries stands of European larch.

Key words: larch, soil, site class, productivity, supply, planting, preservation, humus, acidity, moraine, relief, composition.

Introduction. Much attention breeding of European larch in Belarus has been given to the late 19th early 20th century, when it was introduced widely in gardening culture and forest planting. It currently grows in most of the old parks and in forest plantations throughout.

According to the production of forest associations, there are 61 hectares of plantations of young trees of European larch in the forest fund of the Republic (2011).

In the early 21st century larch as foresting planting material breed was again to be paid a lot of attention due to its high productivity and high value timber. On the territory of many forestry enterprises began to be created artificial plantations of this species in different soil conditions. The establishment of such plantations is partly experimental and requires further study the growth and productivity of plants.

A study of European larch plantations at a young age was carried out. For each selected area the appropriate information about the history and production of forest plantations was collected. It included the initial composition of forest crops, land area, its location (forestry, quarter, recovered), topography, forest plantations characteristics, the type of habitat conditions and forest type, year and season favorites plantations, system, method, and the method of production of forest crops, tillage, density and placement of the initial landing or sown places characteristic of planting material.

The selected test areas of forest crops contained tested areas. The principle idea was that they would not contain less than 400 trees with the condition that the amount of main species trees was at least 200 items. The five test areas was organized. The forestry and forest assessment studies were realized on them. A continuous enumeration with 1-cm diameter classes was performed. In addition, three trees of each stage thickness were measured for their height.

Soil profiles depth up to 2 m were made at all test areas to describe the soil conditions. The morphological features of the genetic soil horizons, indicating the depth of their occurrence, color, texture, size distribution, origin of parent rock, humidity, tumors and others were described. Soil particle size distribution analysis by the method of A. N. Sabanin was carried out in the laboratory conditions. It was necessary to determine the horizons for lung size distribution. And to determine the horizons for heavy granule-metric composition, the method of N. A. Kaczynski was employed. The soil chemical properties were determined according to conventional methods in soil science [2].

Main part. We studied both pure and mixed cultures of European larch being 6-year-old, 8-year-old and 10-year-olds. The tillage was produced by furrows with the PKL-70 plow by the MTZ-82 tractor to a depth of 10–12 cm in spring.

1-year-old European larch seedlings, 1-year seedlings of Pinussylvestris and 2-year-old Norway spruce seedlings were used as planting material.

After 3 years of growth the inventory in the cultures was realized and it became evident that the safety of all test areas ranged from 85 to 92%.

Studies of growth and development of European larch have been made in several forestry enterprises of the republic, namely Negorelskom, Uzda, Novogrudok and Pruzhany. The inventory plantations indices were carefully measured. They are shown in Table 1.

Table 1

Silvicultural and inventory plantations indices

Number	Composition, %	Age	Spicies	Forest type / Forest site type	The number of seats, pcs.	Avarage		Stock, m^3/ha	Type of planting material
						D, cm	*H*, m		
1	100L	10	L	L. sor. / D_2	6,250	5.2	7.4	19.7	$Seedling_1$
2	31L40Sp. 28Pine1Oak	8	L	L. sor. / D_2	2,382	6.7	6.2	8.6	$Seedling_1$
			Pine		1,787	5.0	1.9	3.8	$Seedling_1$
			Sp.		1,787	2.5	0.7	1.1	$Seedling_2$
			Oak		–	3.5	1.3	0.2	Self-seeding
							Total	13.7	–
3	86L14Pine	6	L	L. sor. / D_2	1,852	5.2	5.2	9.2	$Seedling_1$
			Pine		1,852	3.2	1.6	0.5	$Seedling_1$
							Total	9.7	–
4	100L	10	L	L. or. / C_2	3,704	5.6	7.9	10.4	$Seedling_1$
5	96L4Sp.	6	L	L. or. / C_2	1,852	3.1	3.1	2.1	$Seedling_1$
			Sp.		1,852	2.7	0.8	0.1	$Seedling_2$
							Total	2.2	–

Trial plots were laid in stands of different compositions, aged from 6 to 10 years, with a margin from 2 to 20 m^3/ha. As can be seen from Table 1, pure and mixed plantations in composition with the share participation of larch were studied from 31 to 100% as determined by the number of trunks. The composition also meet European spruce, Scots pine and English oak, their share of participation from 4 to 40%.

Listvyaga Kislichnaya (PP 1–3) and fern (PP 4–5) are the forest types that are found on the mensioned areas. Productivity stands of European larch, growing in Kislichnaya forest types, is higher than in the plantations of the same age growing in the fern forest types. The stock of plantations varies from 2.2 m^3/ha on the PP 5 in the age of 6 years old to 19.7 m^3/ha at the age of 10 years old.

When analyzing taxation rates, namely, the diameter and height, it has been found: in the age of 10 years old, these figures are the highest, e.g. at PP 1 European larch has an average diameter of 5.2 cm and an average height of 7.4 m, and at PP 4 its average diameter is 5.6 cm and its average height is 7.9 m. If we compare European larch with other breeds, e.g. PP 3, the regularity can be evidentely seen: the larch has a higher inventory indices, i.e. height is 5.2 cm, diameter is 5.2 m, and at the same age height of Scots pine is 1.6 m and its diameter is 3.2 cm.

Analyzing the Table 1, we observe the following regularity: the reserve in young stands depends on the number and age of planting material, i.e. by the age of 10-year-old the seating capacity of PP 1 is 6,250 pieces and the highest stock of plantations 19.7 m^3/ha.

Table 2 shows the particle size distribution of the soil.

When analyzing the soil profile structure PP 1, 2 and 5 have a dense underlying moraine rock from a depth of more than 1 m. It explains the fact that at age of 10 years old the reserve in these stands is much higher. At the PP 1 soil profile illuvial sandy horizon is 40 cm and the PP 4 parent rock is represented with consolidated sand. In other soil horizons are represented by consolidated and open-grained horizons. The particle size distribution of significant patterns in the content of the individual fractions is not observed. Sand fractions are present in the greatest quantity. Also, there is a large proportion of coarse participation that indicates mainly the formation of soils on moraine soil-forming rocks.

The chemical analysis of soils was realized. Soil fertility is largely dependent on the content of humus, since it contains the basic elements of the power plant. Analysis of the chemical properties of the soil used for growing European larch on them showed that humus has a fairly high degree of security and varies in the upper levels from 2.49 to 4.30%, and the depth of this indicator decreased significantly and ranged from 0.71 to 2.57%.

Considering the acidic soil conditions the following regularity can be observed: the pH in the humus horizon ranges from 3.9 to 4.6. With the depth of the soil profile the figure increases, but with the exception of soil PP 4 and 5, where the figure in the lower horizons decreases a few. All surveyed soils are strongly acidic and sour. According to the content of mobile forms of phosphorus all genetic horizons are strongly means-NASA-occur during the phosphate fertilizers, as the number of rolling P_2O_5 per 100 g soil is less than 10 mg per 100 g of soil, with the exception of genetic horizon B_2, PP 2, and genetic horizon A_2B_1 PP 4.

Table 2

The particle size distribution of the soil, %

Number	Genetic horizon	Depth of horizon, cm	Size, mm						Granulometric composition
			Coarse soil	Fine grained soil					
			3–1	1.0–0.5	0.50–0.25	0.25–0.05	0.05–0.01	<0.01	
1	A_1	4–17	13.4	29.0	19.8	10.4	10.5	16.9	Consolidated sand clay
	A_2B_1	17–30	10.8	24.5	24.7	12.4	11.2	16.4	Consolidated sand clay
	B_2	30–100	13.8	20.3	24.1	8.5	15.9	17.4	Consolidated sand clay
	B_3g	100–140	11.3	60.6	16.7	2.2	4.0	5.2	Consolidated sand
	D	140–200	5.8	21.9	19.8	15.6	12.5	24.4	Light clayey soil
2	A_1	4–20	0.8	12.5	21.6	27.3	16.5	21.3	Light clayey soil
	A_2B_1	20–45	–	11.4	18.7	41.5	12.7	15.7	Consolidated sand clay
	B_2	45–75	1.1	8.7	21.2	43.8	10.4	14.8	Light sand clay
	D	75–200	2.5	21.1	22.1	33.6	8.4	12.3	Light sand clay
3	A_1	3–28	1.1	13.7	29.3	21.6	15.5	18.8	Consolidated sand clay
	A_2B_1	28–60	0.8	11.6	25.1	32.5	11.6	18.4	Consolidated sand clay
	B_2	60–105	1.1	23.4	17.2	35.6	8.2	14.5	Light sand clay
	D	105–200	5.1	33.3	11.4	15.6	13.0	21.6	Light clayey soil
4	A_1	3–16	0.8	15.6	31.2	28.5	8.1	15.8	Consolidated sand clay
	A_2B_1	16–42	3.2	23.8	27.4	14.7	12.5	18.4	Consolidated sand clay
	B_2	42–80	1.8	18.7	22.4	35.1	7.8	14.2	Light sand clay
	Cg	80–200	1.7	16.7	33.4	29.0	11.7	7.5	Consolidated sand
5	A_1	4–21	2.0	12.1	27.4	30.6	15.7	12.2	Consolidated sand clay
	A_2B_1	21–51	1.9	9.5	37.4	28.0	12.0	11.2	Light sand clay
	B_2	51–130	2.1	14.8	23.7	33.8	13.1	12.5	Light sand clay
	D	130–200	5.2	12.6	33.1	19.6	8.1	21.4	Light clayey soil

Conclusion. Interconnection conditions of growth and productivity of plantations can be traced by comparing the content of physical clay in the upper horizons with the stock plants. When comparing taxation indicators PP 3 and 5 at the 6 years old of age a higher margin can be noticed. It happens due to the type of planting material and age, in addition to the upper horizons there are presented with cohesive sandy loam, while PP 5 upper horizons are presented with loose sandy loam. The presence of the underlying loamy horizon also has a positive impact on productivity when compared to PP 1 and 4 at the age of 10. The stock is almost 2 times higher. The humus horizon of the soil listvyagov has a high content of organic matter, high acidity, which is naturally decreasing below the profile. The degree of soil sufficiency with nutrients is low, and the degree of saturation of the soil bases with depth increases almost twice.

References

1. Yanushko A. D. Growing conditions and crop productivity of European larch (*L. decidua* Mill) in BSSR. *Sbornik botanicheskikh rabot* [Collected works geobotanic], 1960, pp. 145–154 (in Russian).

2. Blintsov I. K., Zabello K. L. *Praktikum po pochvovedeniyu* [Practical course on soil science]. Minsk, Vysheyshaya Shkola Publ., 1979. 207 p.

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