

GROWTH AND DEVELOPMENT OF HYBRID POPLARS BELONGING TO THE WORLD SELECTION IN MEDIUM SALINITY SOILS OF NORTHERN POLAND

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Abstract. This article describes the annual growth indicators of 7 foreign-selected varieties (Carpacio, UAS 235, 89.M.011, TIE POLO, LUX, Bellini, ITA 199), local white poplar and the local-selected hybrid variety "Stremitelny" (Ozolin) in moderately saline soils of the Nukus district of the Republic of Karakalpakstan. The most rapid (fast) growth in terms of annual height growth of seedlings was observed in the foreign hybrid varieties "Tie Polo", "Lux", "Bellini" and "ITA 199". It was found that the "Tie Polo" and "Lux" varieties increase their annual height growth by 1.4-1.5 times (150%) compared to the local white poplar and the "Stremitelny" (Ozolin) variety, and the "Bellini" and "ITA 199" varieties by 1.2 times (121-127%).

Keywords. Moderately saline soils, foreign selection, hybrid poplar cultivars, fast-growing, introduction, control variant, growth in annual height and body thickness, genome, physiological and climate adaptation mechanisms.

Introduction. Poplar (Latin *Populus*) is a fast-growing, high-yielding, and adaptable tree that can withstand a variety of climatic conditions. More than 30 species of poplars are known worldwide, and they are mainly distributed in the Northern Hemisphere, particularly in Europe, Asia, and the Americas. Since the second half of the 20th century, poplar cultivation has developed as an important sector in industry, agriculture, and ecology.

Currently, there are international organizations working on the development of poplar in the world, including the International Poplar Commission (IPC) under the UN FAO, the European Poplar Commission, and the China Poplar Center. They coordinate scientific research on genetic selection, introduction, biotechnology, and the creation of climate-adapted varieties.

Poplar cultivation is one of the most developed industries in China, with more than 9 million hectares of poplar plantations in the country. Chinese scientists (Zhang et al., 2015, Fang et al., 2019) have studied the genome, physiological and climate adaptation mechanisms of poplars in depth and have created drought-resistant and disease-resistant hybrid varieties. In China's experience, poplar plantations are used not only for the timber industry, but also as a source of biomass energy.

The development of poplar cultivation is of great importance in the conditions of Uzbekistan and the Central Asian region. This is especially relevant from the point of view of preserving soil moisture in drought-prone areas, creating windbreaks, greening populated areas, and providing local wood raw materials. Therefore, one of the important tasks of today is the scientific development of poplar cultivation in the Republic of Uzbekistan, the creation of high-yielding and disease-resistant varieties suitable for the local climate, the introduction of intensive agrotechnology, and the improvement of the system of sustainable management of poplar plantations.

Materials and methods. Experiments on growing seedlings of poplar hybrid varieties related to world selection were carried out in the conditions of highly saline soils of the Karakalpakstan Scientific Experimental Station, Nukus district, Republic of Karakalpakstan. In this regard, 7 hybrids of poplar introduced from Turkey, France, Italy and Spain and 2 local poplar species were tested by the Research Institute of Forestry during 2017-2019.

1. Foreign hybrid varieties - Carpacio, UAS 235, 89.M.011, TIE POLO, LUX, Bellini, ITA 199.

2. Local white poplar (*Pópulus álba*) - was adopted as a control variant.

3. Local “Stremitelny” (Ozolin) hybrid poplar variety (Latin name must be found) - was adopted as a control variant.

The climatic conditions of the studied area are sharply continental (variable), with the long-term average temperature in January being around $-4.5-7.6^{\circ}\text{C}$, while the lowest temperature drops to $-32-33^{\circ}\text{C}$, and in some places to -40°C . The real winter lasts 3 months. The sum of negative temperatures during the winter period is -500°C in the north and -300°C in the south.

The summer months are characterized by an air temperature $1.7-4.6^{\circ}\text{C}$ higher than the average for many years (June -26.7°C , July -32.4°C , and August -26.2°C). The annual precipitation is 120-125 mm, with the maximum precipitation falling in the spring (an average of 20 mm in March-April), and the minimum precipitation falling in the summer months (an average of 2-3 mm in July-August).

Poplar cuttings were planted in early spring in a $70 \times 20 \times 15$ cm pattern. Cuttings with a diameter of 1.5 cm and a length of 20 cm were selected. The cuttings were watered 15 times during the growing season. Biometric measurements were carried out monthly to assess the growth and development of poplar seedlings. The data collected from the research results were subjected to mathematical and statistical analysis based on the method of G.N. Zaitsev's “Methodology of biometric calculations” (1973) [6].

Discussion of the results of the study. The studies showed that among the hybrid poplar species, the highest results in terms of rapid (very rapid) growth of seedlings in annual height and trunk thickness were mainly observed in all foreign hybrids, including the varieties “Tie Polo”, “Lux”, “Carpacio”, “Bellini” and “ITA 199” (table).

At the same time, the highest results in terms of annual growth of one-year-old seedlings in height and trunk thickness were observed in the hybrid variety “Tie Polo”, the height of the seedlings was 220.7 cm, and the trunk thickness was 1.7 cm (table).

This indicated that the growth of seedlings was 1.4-1.5 times (150%) higher, and the trunk thickness was 1.8-2.1 times higher than that of the local white treak and the hybrid variety “Stremitelny” (Ozolin) (control variant).

The varieties “Bellini” and “ITA 199” showed similar results in terms of seedling height and trunk diameter, and no significant differences were found between the variants. The annual growth of seedlings in height was 187.5-187.1 cm, and trunk diameter was 1.2 cm, respectively (table).

When comparing the growth indicators of these poplar varieties with the local white poplar and the hybrid variety “Ozolin” (control variant), the annual growth of seedlings in height was 1.2 times (121-127%) and in trunk diameter - 1.3-1.5 times (130-150%) (table).

The foreign hybrids “UAS 235” and “89.M.011” showed similar average growth rates, with the annual growth rate of seedlings being 180.4-181.4 cm in height and 1.1 cm in body thickness, respectively. No significant coefficient of variation was detected between the variants.

Average one-year growth dynamics of poplar seedlings in moderately saline soils of Nukus district, Republic of Karakalpakstan

No.	Poplar Variety Name	Mea n Value ($M \pm m$)	Σ	V	n	% Relative to Control	t	p
1	Control	H =	19.1	13.0	49	100.0	20.9	0.3

No.	Poplar Variety Name	Mean Value (M±m)	Σ	V	n	% Relative to Control	t	p
	Variant (White Poplar)	146.6 ± 2.74 cm	5	6		0		
		D = 0.8 ± 0.03 mm	0.17	0.12	48	0.54	0.1	3.2
2	Carpacio	H = 192.4 ± 3.11 cm	21.78	11.32	490	100.0	27.5	0.3
		D = 1.1 ± 0.03 mm	0.18	0.10	49	0.58	0.2	2.4
3	UAS 235	H = 180.4 ± 2.48 cm	17.33	9.61	490	100.0	25.8	0.3
		D = 1.1 ± 0.03 mm	0.18	0.10	49	0.58	0.2	2.4
4	Ozolin	H = 153.8 ± 2.69 cm	16.39	10.66	370	100.0	25.3	0.3
		D = 0.9 ± 0.03 mm	0.16	0.10	36	0.55	0.1	3.1
5	89.M.01	H = 181.4 ± 2.41 cm	16.84	9.28	490	100.0	25.9	0.3
		D = 1.1 ± 0.02 mm	0.17	0.09	49	0.59	0.2	2.3
6	TIE POLO	H = 220.7 ± 6.70 cm	44.96	20.36	450	100.0	32.9	0.3
		D = 1.7 ± 0.12 mm	0.78	0.35	45	0.77	0.3	6.8
7	LUX	H = 206.3 ± 6.38 cm	38.25	18.54	360	100.0	34.4	0.3
		D = 1.4 ± 0.11 mm	0.63	0.31	36	0.70	0.2	7.3

No.	Poplar Variety Name	Mean Value (M±m)	Σ	V	n	% Relative to Control	t	p
		mm						
8	Bellini	H = 187.5 ± 3.03 cm	16.6	8.86	30	100.0	34.2	0.3
		D = 1.2 ± 0.04 mm	0.20	0.11	30	0.64	0.2	3.0
9	ITA 199	H = 187.1 ± 3.07 cm	16.8	8.98	30	100.0	34.2	0.3
		D = 1.2 ± 0.03 mm	0.18	0.09	30	0.63	0.2	2.8

The foreign hybrid variety “Carpacio” was found to have a growth rate close to that of the hybrid varieties “Tie Polo” and “Lux”. The annual growth rate of seedlings was 192.4 cm, which was 1.0-1.1 times (7-14%) lower than that of the hybrid varieties “Tie Polo” and “Lux”.

1. Conclusions. The following conclusions can be drawn from the results of the study. In particular:

2. 4. The hybrid poplar varieties “Tie Polo”, “Lux”, “Carpacio”, “Bellini” and “ITA 199” imported from abroad can fully adapt to the moderately saline soils of Karakalpakstan.

3. 5. Among the foreign hybrid poplar varieties, very rapid growth in terms of annual growth in height and trunk diameter can be observed in the varieties “Tie Polo” and “Lux”, and average growth in the varieties “Carpacio”, “Bellini” and “ITA 199”.

4. 6. The varieties “Tie Polo” and “Lux” increase their annual height growth by 1.4-1.5 times (150%) compared to the local white poplar and the variety “Ozolin”, and the varieties “Bellini” and “ITA 199” increase their annual height growth by 1.2 times (121-127%).

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