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POPLAR PLANTATION CROPS IN THE BREEDING AREA "LAVAR" IN SOUTH-EASTERN KAZAKHSTAN

The results of studies on the effect of planting density on growth and development of cultures of different types of hybrid poplar trees on the south-eastern Kazakhstan.

Key words: poplar plantation, tree species, the crown, the hybrid, the productivity

A small percentage of forest land in Kazakhstan and an acute shortage of wood requires foresters to seek ways to improve the productivity of forests and their sustainable use. This deficit in wood can be to some extent offset by the growing plantation crops of fast growing tree species, including species of the best and hybrids of poplar.

The increased interest in Poplar in the world is due to its biological characteristics and economic value. These include their 1) rapidity of growth and the ability to provide technically suitable timber for cutting back in 20 years or less; 2) use in most industries, based on the use of wood; 3) the ability to grow on land that is not always suitable for agricultural use; 4) the possibility of wider use in the protection, landscaping and recreational landings; 5) ability for vegetative reproduction.

Poplar cultivation is very extensive in the country, especially in the south and south-east. Basically, it's occurring in protective plantations in populated areas and along roads. However, poplar plantations a source of business and carpentry of wood, is not always practical. In this regard, there is a need to establish in Kazakhstan the increased growing of poplar plantation crops for timber.

According to Musheghyan (1962) natural flora of south-eastern Kazakhstan is represented by 20 species of poplars. Of those in the region the most common are the Italian Lombardy poplar, deltoid, Bolleana, Bachofeni, an Algerian, black (black poplar), and leafy. But they differ significantly from each other, in both biological and economic characteristics of [2,3,4]. Therefore, Countless [1999] obtained various forms of hybrid poplar trees, which have different pronounced heterosis, high energy growth, and resistance to soil salinity and other economically valuable traits by conducting numerous experiments on interspecific hybridization. As a result of this work, they selected and tested under production conditions in the tract "Lavar" series hybrids of this species. From the section of black poplars the following promising hybrids were obtained and tested:

Poplar "Kazakhstan" – derived from crosses of poplars PKL-284 Alamo. A male. Barrel full timber with straight, slender branches. Well propagated by cuttings. It differs from the Alamo rate of growth, resistance to drought and soil salinity.

Poplar "Kairat" – a hybrid produced by crossing poplars PKL-284 and the deltoid. A male. Than features a distinct trunk, broady pyramidal crown, and large leaves and thin branches. Good propagation trough cuttings.

Poplar "Semirechensky" derived by crossing the Algerian poplar with Alamo. This tree features a small runout trunk line and pyramidal crown. In comparison with the parental species it differs by more rapid growth and, – resistance to soil salinity. Stated below are the sections marked with white poplar hybrids.

Poplar, "62027-1" obtained from crosses of poplars Bachofeni and Bolleana. A male, this tree features a broadly pyramidal crown with a small runout trunk line. It is salt-tolerant, heat-resistant, and fast growing. Compared to other white poplars it is propagated well by cuttings.

Poplar, "67005-5" obtained from crosses with white poplar and Bachofeni. A female this tree also features a broadly pyramidal crown with thin branches. This hybrid also reproduces satisfactorily by cuttings and is salt-tolerant with rapid growth.

Poplar, "62028-13" obtained from crosses with poplars Bachofeni and Bolleana. This male hybrid is features fast growth, and – resistance to soil salinity. The crown' is broadly pyramidal, and the trunk is pronounced, with,- full timber. It is also well propagated by cuttings.

Poplar, "65001-7" obtained by crossing Bolle poplar and aspen. Another male hybrid, this selection has a delicate crown, and pronounced trunk line well-cleaned of twigs. Propagation by stem cuttings is difficult with 30-35% rooting success..

These hybrid poplars were grown on the selection and production site "Lavar", which created by royal-collection office in 1968 and composed of a 2 hectares area. This area was later used to create a 1.5–2 hectare area of annual plantation crops.

A detailed study on the growth rate and productivity of poplar plantations in the south-east of the republic was conducted by Iskakov [1969]. He reported that an Alamo section of the black poplar trees growing in plantations in the floodplain terrace of the rich alluvial-meadow soils with adequate moisture groundwater table at a depth of 150 cm at 10 years of age has reached an average height of 21.0 m and diameter at breast height of 25.1 cm with a volume of 0.35 m^3 trunk. The same species of poplar plantations in the meadow on gray soils medium loamy at the age of 8 years had an average height of 14.1 m and a diameter of 14.4 cm.

High rate of growth is different from the planting of Bolleana poplars (section of white poplar) on gray meadow, medium saline soils. At the age of 15 years, stands of this species of poplar, with regular watering reached a height of 19.3 m and a diameter of 22.8 cm The

growth analysis of the model tree, taken from this stand, showed that the current gains in height and diameter per year falls somewhat, but are still at a fairly high level.

Intensive growth under similar conditions differ Italian poplar Lombardy (section of black poplar), which in the age of 19 may have an average height of the plantation about 20 m and a diameter of 21 cm, although it has in comparison with the poplar Bolle over a sharp drop in the current increment in height and the diameter is a little bit earlier.

Based on these data and results, especially out in the tract "Lavar" Iskakov's [1969] stationary research concludes that the favorable soil and climatic conditions of south-east of Kazakhstan allow for systematic watering to grow high-yield poplar plantations. And that once again we have seen, in 2003, following the relevant research on the progress of their growth and productivity in plantation plantings of various ages in the section "A catastrophe". The site even among the plantation crops, soil, gray desert saline, and ground water at a depth of 3–6 m

To obtain comparative data, only planted 2 hybrid poplars: section of the black – a hybrid poplar "Kazakhstan" section of the whites – a hybrid of "62027-1."

In total there were 6 such sites. At each of these sites, soils were prepared for planting in the fallow system with a mandatory fall loosening to a depth of 31–35 cm before the main treatment of manure was applied at the rate of about 20 tons per hectare. Seedlings, grown from annual cuttings in the department of varietal breeding, were planted in the Spring by hand in pre-prepared holes. In order to study the effect of planting density on growth and development of cultures of poplars, placing seats done in 3 versions – 2,5x1; 3x1, 3x2, and 5 m with a number of plants planted, respectively, 4000, 2220 and 1667 pieces per 1 ha.

Care of plantations consisted of periodic watering, pruning of lower branches, and cultivating between rows. The most frequent watering and mechanical treatments (4–5 fold) were carried out in the first 3–4 years after planting. The main parameters of the plantation, which laid the test areas, are characterized by the data given in table 1.

Since these plantations were established in different years, – from 1968 to 1986, and at the time of our study had unequal ages (from 16 to 35 years), a full analysis of the secondary trunks of model trees was made with one model from each option. This design should make for a more reliable comparison of the progress of growth of these crops. The subsequent analysis compared the following: height, diameter and volume of the trunk and the corresponding current gains by age periods of growth every two years. For ease of comparison, the primary data on the growth of our models are grouped according to individual taxation characteristics (height, diameter, volume of trunk, present, and the average growth rates) and are presented in table 2 and 3.

Table 1 shows that the survival and preservation of cultures was a very high at 91-96% and is independent of the hybrid form, density and the year of planting. This compensates to some extent, differences in the timing of planting in the comparison of experimental results on the options. Table 1 also confirms the findings of Iskakov [1996] on commercial plantations of high poplar productivity under irrigated conditions in the south-east of Kazakhstan: the stock of wood on one hectare of the plantation ranges from 600–650 m^3 at the age of 16–17 years and up to 750–920 m^3 twenty to twenty-three years old. The data in Table 1 also shows that the density of planting to create plantations of poplars have a significant effect on tree growth and wood formation of reserves per unit area. This effect also depends on the biological characteristics of cultivated plants, particularly of hybrid forms.

Most clearly seen when comparing these features of the course of growth medium model trees for planting options studied (Table 2 and 3).

By analyzing the course of growth patterns for height (Table 2) it is primarily evident that a planting of the first few years exhibit more intensive growth in

Table 1

Main characteristics of poplar planting options for experienced and results of their survey in 2002

№ №	A hybrid form of poplar	Year of planting	Placing seats, pieces / ha	The number of plants per hectare planted	Age at the time of the survey years	Preservation,%	The average height, m	The average diameters, cm	The average volume of the trunk, m^3	The actual timber volume per hectare, m^3
1 1	"Kazakhstan"	1985	2,5x1,0	4000	17	96	19,3	16,2	0,1577	606
22	-//- -//-	1979	3,0x1,5	2220	23	92	22,3	24,0	0,4149	846
33	-//- -//-	1980	3,0x2,0	1667	22	92	23,0	24,2	0,4720	722
44	Form 62027-1	1986	2,5x1,0	4000	16	96	18,1	19,1	0,1716	659
55	-//- -//-	1982	3,0x1,5	2220	20	93	21,5	20,0	0,2983	616
66	-//- -//-	1982	3,0x2,0	1667	20	91	22,5	24,7	0,4974	755

Table 2

Stroke model of growth of trees on height, depending on planting density (figures in meters)

Age years	Hybrid poplar “Kazakhstan”									Hybrid poplar “62027-1”								
	4000 pieces per 1 ha			2220 pieces per 1 ha			1667 pieces per 1 ha			4000 шт pieces per 1 ha			2220 pieces per 1 ha			1667 pieces per 1 ha		
	Diameter of 1.3 m, cm	The amount of cross-sectional area to 1 ha, m²	The current increase in diameter, cm	Diameter of 1.3 m, cm	The amount of cross-sectional area to 1 ha, m²	The current increase in diameter, cm	Diameter of 1.3 m, cm	The amount of cross-sectional area to 1 ha, m²	The current increase in diameter, cm	Diameter of 1.3 m, cm	The amount of cross-sectional area to 1 ha, m²	The current increase in diameter, cm	Diameter of 1.3 m, cm	The amount of cross-sectional area to 1 ha, m²	The current increase in diameter, cm	Diameter of 1.3 m, cm	The amount of cross-sectional area to 1 ha, m²	The current increase in diameter, cm
2	0,6	0,1		-	-		-	-		0,8	0,2		_			1,2	0,2	
			1,9									1,2						1.1
4	4,4	6,1		1,4	0,3		0,8	0,1		3,2	3,2		1,6	0,5		3,4	1,5	
			2,1			1,0			0,6			1,6			1,1			1,4
6	8,6	23,2		3,4	2,0		2,0	0,5		6,4	12,9		3,8	2,5		6,2	5,0	
			1,1			2,0			1,3			2,1			1,7			1,7
8	10,8	36,6		7,4	9,5		4,6	2,8		10,6	35,3		7,2	9,0		9,6	12,1	
			0,8			2,4			2,7			1,4			1,3			1,7
10	12,4	48,3		12,2	25,9		10,0	13,1		13,4	56,4		9,8	16,7		13,0	22,1	
			0,5			1,4			2,4			1,0			1,6			1,5
12	13,4	56,4		15,0	39,2		14,8	28,7		15,4	74,5		13,0	29,5		16,0	33,5	
			0,6			1,3			1,6			1,0			1,4			1,2
14	14,6	66,9		17,6	54,0		18,0	42,2		17,4	95,1		15,8	45,5		18,4	44,3	
			0,6			1,1			0,8			0,8			0,8			1,0
16	15,8	78,4		19,8	68,3		20,4	54,5		19,0	113,3		17,4	52,8		20,4	54,5	
						0,7			0,7						0,8			1,4
18				21,2	78,3		21,8	62,2					19,0	62,9		23,2	70,4	
						0,5			0,9						0,4			0,8
20				22,2	85,9		23,6	72,9					20,2	71,1		24,8	80,5	
						0,6			0,3									
22				23,4	95,4		24,2	76,6										
						0,4												
23				23,8	98,7													

Table 3

Progress in the growth medium model tree poplar, "Kazakhstan" in terms of stems and stem volume per hectare (location 2.5x1.0 m, preserved trees on 3840 hectares, placing 3.0 x 1.5 m, preserved trees, 2040 ha, placing 3.0 x 2.0 m, preserved trees on 1530 ha)

Age, years	4000 trees per 1 ha					2220 trees per 1 ha					1667 trees per 1 ha				
	The volume of the trunk, dm^3	The current increase in the volume of the trunk, dm^3	Timber volume per hectare, m^3	The current increase in stock per hectare, m^3	The average increase in stock per hectare, m^3	The volume of the trunk, dm^3	The current increase in the volume of the trunk, dm^3	Timber volume per hectare, m^3	The current increase in stock per hectare, m^3	The average increase in stock per hectare, m^3	The volume of the trunk, dm^3	The current increase in the volume of the trunk, dm^3	Timber volume per hectare, m^3	The current increase in stock per hectare, m^3	The average increase in stock per hectare, m^3
2	0,2		0,8		0,4	0,1		0,2		0,1	0,1		0,2		0,1
		2,9		11,6			0,2		0,4			0,05		0,1	
4	6,0		24,0		6,0	0,5		1,1		0,3	0,2		0,3		0,1
		13,4		53,6			1,3		2,9			0,8		1,3	
6	32,8		131,2		22,0	3,8		8,4		1,4	1,8		3,0		0,5
		14,3		57,7			7,7		17,1			5,1		8,5	
8	61,4		245,6		30,7	19,2		42,6		5,3	12,0		20,0		2,5
		13,5		54,0			22,6		50,2			17,1		28,5	
10	88,3		353,2		35,3	64,4		143		14,3	46,2		77,0		7,7
		12,6		50,4			28,2		62,6			38,3		63,8	
12	113,4		453,6		37,8	120,8		268,2		22,4	122,7		204,5		17,1
		11,0		44,0			34,4		76,4			42,0		70,0	
14	135,4		541,6		38,7	189,6		420,9		30,1	206,7		344,6		24,6
		11,1		44,4			36,5		81,0			49,4		82,3	
16	157,7		630,8		39,4	262,6		583,0		36,4	305,4		509,1		31,8
							23,8		52,8			31,4		52,3	
18						310,3		688,9		38,3	368,2		613,8		34,1
							22,0		48,8			33,1		55,5	
20						354,4		786,8		39,3	434,4		724,1		36,2
							20,0		44,4			18,8		31,4	
22						394,3		875,3		39,8	472,0		786,8		35,8
							20,6		41,5						
23						414,9		921,1		40,0					

height compared to the more sparsely planted. This is particularly, clearly expressed in poplar, "Kazakhstan", in which: the current annual increment in the first 4 years increases in planting a density of 4000 units / ha (2.5x1 m) from 1.5 to 3 meters, with density of 2220 units / ha from – 0.65 to 1.35 m and at 1667 units / ha, from 0.5 to 1 m. The future growth of close planting is reduced and almost stopped at the age of 10 years, (20–15 cm per year). In a rare crop planting, current annual increment growth continues to increase.

With an average density of (2220 units/ga) – slower, with a very sparse (1667 units/ha) – more dramatically – up to 3 meters per year in 4–6 years of age.

Slowing growth in the sparse stands occurs later than in the dense and moderate stands. The almost complete attenuation of growth in height of trees in the sparse planting occurs at age 18 (an increase of -15-20 cm per year). The hybrid poplar, 62027-1, expressed the same, especially when the average density was very low. We attribute this to biological characteristics of these forms.

More rapid height growth in the dense plantings in the early years can be explained the rapid closing crowns. This is especially true in the ranks, when, on the one hand tree crowns shades the soil surface and reduces direct evaporation of moisture from it, but on the other – has the effect of "snapping" or rather "samopodgona "due to the earlier lateral shading trunks and crowns. In the denser plantings the crowns grow narrower and taller, while in the sparse plantings crowns are sprawling and leafy, which are affected over time by a general increase in diameter growth and the volume of barrels.

The course of diameter growth was also very similar to the high dynamics of growth over age. In the dense cultures the maximum current increment in age was from 2 to 6–8 years in medium-density, from 6 to 14 years, and, in the sparse – from 8 to 16 years in poplar, "Kazakhstan", and from 4 to 14 in the poplar 62027-1. This dependence is correlated with the nature of crop height growth, 2 years as measured by diameter at breast height (1.3 m). In the dense planting of plant height reached after a year of growth, at an average density and still later at a sparse density (except for the shape of 62027-1).

You should also note the connection between the course of growth experienced and the fullness of crop plantings, or rather with the total basal area of trunks (at breast height per hectare). Table 2 shows that a fairly sharp drop in the current growth in diameter occurs in cultures of poplar "Kazakhstan", when this figure reaches 23 m^2 per ha in dense plantings and 26–29 m^2 per ha in the sparse and very sparse. In total basal area of about 50 m^2 per hectare increase is reduced to a minimum. In poplar form 62027-2, this criterion is somewhat higher (about 30–35 m 2 ha), but in general similar.

The volume stems almost a derivative value of their diameters and heights, so the patterns change with age. They are similar, to, the volume of barrels, which is a – more important factor than its diameter and height. Table 3 shows that the current increase in the volume of poplar trunks "Kazakhstan" in a dense form increases with age more rapidly than in the more sparse, reaching a maximum at 6.8 years of life (14.3 dm3) against 14–16 years in the moderate density and sparse plantings (36.5 and 49.4 dm^3). However, the total basal area over 23 m2 per hectare begins to fall behind (2–3)?? in the growth of trees in the planting of sparse density variants in which the current increase in the volume increases up to 14 years.

Timber volume per hectare, – the main indicator of the productivity of plantations, – depends on the growth of trees in a given planting density or number of trees per unit area. Table 3 shows that the most productive version of the poplar was "Kazakhstan" with the placement of seats 3.0x1.5 meter margin on 1 hectare with 921 m^3 of timber, with an average increment of 40 m3 per 1 ha. The version of the deployment of seats 3.0x2.0 m (1667 plants per hectare) lags behind. And the 2220 plants per hectare stocking groups produced 786.5 m^3 of timer, with an average growth of about 36 m3 per hectare.

In these embodiments average gain per hectare timber close to the current is aged at 20–23 years, which indicates the occurrence of quantitatively mature plantations. However, given the extremely high current gain in excess of 30–40 m^3 per hectare, cutting age should be determined by the technical maturity, probably much later in life.

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