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Poplar and poplar hybrid in the green zone of Astana, Kazakhstan

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Abstract

In the present day, the legal framework and economic conditions in the Republic of Kazakhstan correspond to successfully implement the project of industrial plantations of forest by different country. Soil-orographic and climatic conditions also have not critical differences from the leaders countries of forest plantation. As shown practice, the moratorium on logging does not correct the low forest cover of the country. The various categories of land, that not using in agricultural necessary to use suitable for forest growing. The industrial plantation projects should be carried out on a large scale at the national level. In view of the above, in arrangement purposes for the organization of plantation forest growing in the country are determined by the following priority areas: a) Defining of tree species range and a list of goals and objectives for forest plantations, b) Selection and systematization of knowledge and technological standards for plantation forest with the definition of the category of land allocating. The subject of this study is Kazakhstan's poplar and poplar hybrid, which is growing in the forestry "Batys" RSE "Zhasyl Aimak" Akmola region. Type of forest plantations is composed of six-rows. The width of the rows is 24 m, spaces between of scenes are 12 m, between rows is 4 m. Scheme of offset: 4 - main breeds, accompanying breed as well as shrub. Planting was carried out with deep-root grafts, the distance between seats in a row: the main breed - 1.5 m, accompanying breed -1 m. Density of planting makes up 2500 pcs/ha. Biometric indicators of woody plants were measured: height, current increment in height, diameter at height of breast and diameter of root collar, diameter of crown along and across the row. The aim is to study the status of available crops of poplar and using of biomicrofertilizer "Ekstasol" and growth stimulator "Karpansil". When processing biomicrofertilizer "Ekstasol", preservation for all test variants of Kazakhstan Poplar was higher than the control and were as follows: for a period of soaking for 30 minutes - 75.5%, while soaking for 60 minutes - 85.8%, in control - 65.0%. The growth were significantly higher in two variants than in control: 48,5 (t = + 4,5), 52,8 (t = + 6,0), 38,0 cm. Stimulant karpansil was tested at term of soaking is 30 minutes, which had a positive impact on growth, although statistically significant differences were not observed. There were significant differences were in growth and reached 6.8 cm.

Key words: Poplar, hybrid, plantation, biomicrofertilizing, stimulant

1. Introduction

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 production can be to some extent offset by industrial plantation using fast growing tree species.

It is well known that green plantation help to improve the microclimate, environment, reduce a noise, and also have an aesthetic and ecological value.

The area of studying is located in the steppe zone, subzone of dry fescue-feather grass steppes with a sharply continental climate, characterized by significant deficit of moisture, inclement and prolonged winters with little snow, strong winds and waves in temperature within days. Besides; wood production, plantations can be used also creating forest culture in the green belt performing sanitary functions, protecting the city from the strong winds, movable sand and dust.

The increased interest in poplar, including species of the best and hybrids of poplar in the world is due to its biological characteristics and economic value. These include 1) rapidity of growth and the ability to provide technically suitable timber for cutting back in 20 years or less; 2) usable in most industries, based on the use of wood; 3) the ability

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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. Yer et al. (2016) have also expressed because of *Populus* broad dispersion and usage as a source for paper production and as a bioenergy source supported by rapid growth and high genetic diversity, poplar plays a crucial role in economy and ecosystem. The species of *Populus* presents splendid opportunities to examine stress responses toward drought which affect not only survival but also biomass accumulation (Marron et al., 2002; Monclus et al., 2006).

The aim is to study the status of available crops of poplar and using of biomicrofertilizer "Ekstasol" and growth stimulator “Karpansil”.

2. Materials and methods

The subject of this study is to evaluate of Kazakhstan’s poplar and poplar hybrid, which is growing in the forestry "Batys" RSE "Zhasyl Aimak" Akmola region. Plantations were established in a six-row design. Width of one row is 24 m, distance between rows is 4 m. Schematic layout of experimental plot is S-P-P-P-P-S (S for *Salix*, P for *Populus*). The distance between poplars in a row is 1.5 m and between willows 1.0 m. One years old cuttings was used in the experiment. Cuttings heights were 20 – 25 cm and diameters were 0.8 – 1.0 cm). Plantations were weeded between rows and around the research site twice in the first two years. The site was irrigated twice during the first year, once during the following year and then it was no longer irrigated.

Trees were studied using a conventional method (Anuchin, 1983). It has been measured biometric parameters such as averages of tree heights, stem diameter at breast height (DBH) and diameter of crown. Analysis of the measurement results were performed using a program based on Analysis of Variance. Survival rate of plants in the area is defined by the formula 1.

Formula 1. Calculation of survival rate in experiment:

$$S = \frac{\left(L+\frac{1}{2}D\right)}{s} x100 \quad (1)$$

S – the percentage of survival; L – the number of living plants pcs .; D – the number of precarious plants pcs (it mean that plants are half alive or survival is doubtful).; s – is the number of seats, pcs. Survival rate is determined with an accuracy of ± 5%.

Influences of biomicrofertilizer "Ekstrasol" and growth stimulator "Karpansil" were studied in the spring 2014 before planting of cuttings. Root system of hybrid poplars was treated in the mash with the addition of an integrated liquid organic fertilizer, then they were compared with growth in no treatment control.

3. Results

Kazakhstan poplar treat to section of black poplars, was obtained by crossing poplar PK1-284 with *P. deltoides*, derived from selection by professor P.P. Besschetnov. The clone is resistant to pests and diseases, drought and salinity, well propagated by stem cuttings. On saline soils with irrigation the cutting can be reached 182,5 ± 6,7 cm, height in the first year after planting 385.6 + 12.4 cm at the age of two and 572,3 ± 9,4 cm in third year (Besschetnov, 1969).

The average volume of individual trees of poplars in the south-east of Kazakhstan at the age of 23 is found 0.4-0.5 m^3. Plantations may also be used wood and biomass as well as a source of feed and hay for cattle (Sarsekova and Zasada, 2014)

Plantations established on degraded lands in Boom, Belgium, without irrigation, fertilizers and fungicides had average dry biomass 4,3 ± 3,4 t per ha per year in all clones during the fourth rotation, but the most productive clones yielded up to 10.5 t per ha-per year. After 16 years, the safety range of 6 to 91% of the clones (Dillen et. al., 2013).

Planting of hybrid poplar was done in spring 2008 in the forestry "Batys" (54 quarter, sub compartment №5, on the square of 43,7ha) RE "Western direction." In total 20278 pieces of cuttings were planted on conditionally forest suitable soils (III group of forest suitability).

Creating relatively stable wood landings on probation forest applicable soils is possible only with a high level of farming. Soils with the presence of alkali up to 25% or containing a significant amount of water-soluble salts in the upper 2-m layer are the limiting factor for the expansion of the range of salt-tolerant species. The degree of forest applicable soils is identified by the presence of forest plantings of 4-5 m high, the safety of more than 50% at 10 years of age and the lack of mass drying signs.

Type of forest plantations is composed of six-rows. The width of the rows is 24 m, spaces between of scenes are 12 m, between rows is 4 m. Scheme of offset: 4 - main breeds, accompanying breed as well as shrub. Planting was carried out with deep-root grafts, the distance between seats in a row: the main breed - 1.5 m, accompanying breed -1 m. Density of planting makes up 2500 pcs/ha.

Agro technical care consisted of cultivation between rows and along the edges, watering was made during the first two years. Been measured biometric indicators of woody plants: height, current increment in height, diameter at height of breast and diameter of root collar, diameter of crown along and across the row. The results are shown in table 1.

Table 1. Biometric performance hybrid poplar

Name of species	Statistical indicators	Average biometrics indicators				
		Height	Diameter	Diameter at the root collar	Diameter of the crown	
					along a row	across a row
	x ± m	403±3,1	3,94±0,09	4,14±0,1	123,6±7,0	143,6±7,0
Hybrid poplar	**δ***	9,4	0,09	0,1	8,5	8,6
	V,%	7,4	7,9	7,9	20,2	20,8
	P,%	2,3	72,5	7,9	2,8	3,0

* δ - standard deviation

As can be seen from table 1, the average height of a hybrid poplar was 403 cm, diameter at height of breast - 3.94 cm and a diameter at the root collar was 4.14 cm.

During the growing season, inventory of the forest, constant monitoring of the growth and the condition of poplar were observed.

Preservation of Kazakhstan Poplar at the age of 4 on probation forest suitable soils makes up 71,4%. Indicators of the average height is 158,2±8,0. Growth is 41,8±3,5, diameter of crown along a row is 113,6±7,0 and across a row is 123,6±7,2.

Preservation of poplar hybrid at the same age makes up 58,5%. Indicators of the average height: 134,2±8,0. Growth is 38,8±3,5, diameter of crown along a row is 96,6±6,0 and across a row is 103,6±7,1 (Table 2).

Table 2. Biometric indicators of four-year crop for 2014 year

Name of species	Year of study	Preservation %	Indicators of growth			
			a high	growth	length of crown	
					along a row	across a row
Kazakhstan Poplar	2014	71,3	158,2±8,0	41,8±3,5	113,6±7,0	123,6±7,2
Poplar hybrid	2014	58,5	134,2±8,0	38,8±3,5	96,6±6,0	103,6±7,1
Salix alba	2014	97,8	55,1±2,6	-	37,2±2,4	40,4±2,5

Accompanying species in the planting scheme is white willow, which showed high preservation - 97.8%. Below shows the dynamics of survival experienced the age of four crops (Table 3).

Table 3. Dynamics of preservation of experienced cultures on the age of four

No	Name of species	Take root for years, %		
		2012	2013	2014
1	Kazakhstan Poplar	86,6	74,0	71,4
2	Poplar hybrid	84,4	76,2	58,5

As can be seen from Table 3 survival rate of Kazakhstan Poplar during the period of 2012 makes up 86,6%, 2013 - 74,0, 2014 - 71,4%. Poplar hybrid has survival rate in 2012 - 84,4%, 2013 - 76,2% and for 2014 - 58,5%.

We are first conducted research on the use biomicrofertilizing "Ekstasol" and growth stimulant Karpansil. To do this, the spring 2014 planting root system of planting material before planting poplar Kazakh soil was treated in the mash with the addition of a liquid complex organic mineral fertilizer, root systems soaked for 30 and 60 minutes. Control - untreated planting.

To determine the influence of drugs assessment took differences in terms of growth, as the height could be affected by the initial height of the planting material.

Test landing preparations biomicrofertilizing "ekstasol" and growth stimulant karpansil showed various positive their effectiveness (Table 4).When processing biomicrofertilizer "Ekstasol", preservation for all test variants of Kazakhstan Poplar was higher than the control and were as follows: for a period of soaking for 30 minutes - 75.5%,

while soaking for 60 minutes - 85.8%, in control - 65.0%. The growth were significantly higher in two variants than in control: 48,5 (t = + 4,5), 52,8 (t = + 6,0), 38,0 cm. Stimulant karpansil was tested at term of soaking is 30 minutes, which had a positive impact on growth, although statistically significant differences were not observed. There were significant differences were in growth and reached 6.8 cm (t = 3,6).

Table 4. Effect of biomicrofertilizing with different terms soaking the root system before planting on growth of poplar Kazakhstani

Variant of experience	**Preservation %**	**Indicators of growth (X±m), cm**		**Probability distinction (t≥ 3,0)**
		hiegth	growth	
Biomicrofertilizing "ekstasol"				
Term of soak for 30 minute	75,5	74,9±1,7	48,5±1,6	+4,5
Term of soak for 60 minute	85,8	79,2±1,5	52,8±1,8	+6,0
Control	65,0	69,4±1,4	38,0±1,7	-
Growth stimulant "karpansil"				
Term of soak for 30 minute	78,0	82,3±3,5	45,6±1,5	+3,6
Control	77,8	75,5±2,9	38,8±1,2	

4. Conclusions and discussion

Observation and analysis of studies of cultures poplar showed that their productivity could be significantly higher in the rich fertile soils. Plantation of Kazakhstan poplar and hybrid poplar started on conditional forest suitable soils with accommodation 4 x 1.5 m at the age of 4 years, reaching a height of 158.2 and 134.2 cm. It is recommended to use biomicrofertilizing "Ekstasol" for a period of soaking for 60 minutes and use growth stimulant "Karpansil".

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