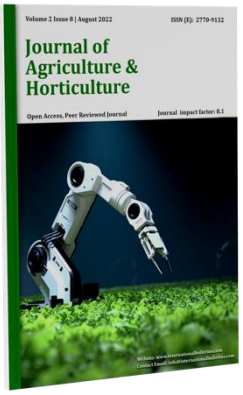

STUDY OF THE INFLUENCE OF PLANTING METHODS ON THE SURVIVATION AND GROWTH OF CRIMEAN PINE SEEDLINGS WITH CLOSED ROOTS IN THE SOUTHERN MOUNTAIN TERMINAL OF THE TIAN SHAN IN UZBEKISTAN

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https://doi.org/10.5281/zenodo.13148180

Abstract: The article presents the results of an experiment on studying the survival rate of young Crimean pine seedlings planted with closed roots using different planting techniques on the southern slopes of the Tien Shan. The research found that the best survival rates were in variants with deep planting, when the root system of the plants was in deeper soil horizons, as well as with the addition of colloid Carboxymethylcellulose (CMC) to the soil.

Keywords: *forested area, planting material with closed root system, planting methods, deep planting, structure-forming agent, linear colloid, carboxylmethylcellulose (CMC), survival rate, annual growth.*

Introduction. Currently, the forested area of mountain slopes in Uzbekistan is very low and makes up less than 2% of the total area of mountains. The main reasons for the reduction of their area are, first of all, the increased intensity of negative anthropogenic impact on mountain areas, which includes excessive and unregulated grazing, excessive felling of trees for firewood and plowing of slopes for their development for the purpose of introducing agricultural crops. In this regard, desertification of lands associated with water erosion of slope surfaces, washout of the fertile soil layer, development of gullies, ravines and landslides has increased significantly. As a result, more than 90% of the lands of the mountain slopes of the Republic have been eroded. These circumstances have raised questions for foresters about developing effective measures to prevent erosion processes [1].

One of the main ways to eliminate such threats is to create artificial forest crops using high-tech methods. Only forests can perform the most effective anti-erosion functions, creating soils with high filtration capacity due to deep root systems and annual leaf fall [5].

However, the creation of forest crops in Uzbekistan is complicated by specific climatic conditions – high air temperatures and lack of precipitation during the hot summer period, when plants need soil moisture most [1,5].

These reasons cause a large loss or complete destruction of forest crops created using currently existing technologies. According to them, plantings are created using planting material with open roots. At the same time, when digging from the nursery, the root system of the seedlings is severely cut off. When planted in a new place, it does not have time to recover before the onset of drought and many plants die or become seriously ill and lag behind in growth. The effectiveness of traditional methods of creating forest crops is very low. Their survival rate does not exceed 50%, which not only leads to additional costs for supplementing and increasing the growing period until forest-covered areas are obtained, but also to the planned protective effect of the created plantings [2].

In connection with the above circumstances, an urgent task is to find other methods of planting with new agricultural techniques and improved forest planting material. Therefore, in order to increase the survival rate of plantations in forest cultures on mountain slopes, we conducted experiments on testing one-year-old pine seedlings with a closed root system (PMZK), grown in polyethylene containers 25 cm high and 10 cm in diameter in a substrate consisting of equal parts of fine earth, manure and river sand. Pine seedlings of the same age from a regular forest nursery were taken as a control.

The experiment on creating forest crops from PMZK was conducted under production conditions on the southern slopes of the Tien Shan at an altitude of 1200 - 1500 m above sea level in the Sukoksai River basin. The steepness of the slopes was about 250. The soils of the experimental plot are brown carbonate on loess-like loam. The average amount of precipitation, according to long-term data, is 760 mm. The daytime air temperature in mid-summer (July-August) reaches + 36-37 °C. The distribution of precipitation is extremely uneven. The maximum precipitation is confined to the spring period (383 mm or 43.4%), and the minimum - to the summer (38 mm or 4%). The lack of precipitation in the hot summer period annually leads to soil drought, in which the moisture content of the upper soil layers drops to the wilting point, which is the reason for the low survival rate or death of forest crops.

Materials and methods. An analysis of the available literature showed that in arid conditions with a sharply continental climate with no precipitation in the summer, in which Uzbekistan is located, such work has been carried out only with tree-like juniper (archa) in the coniferous forest belt at altitudes of more than 2000 m above sea level in the temperate climate zone [3]. For the deciduous forest zone with more severe forest growing conditions, work in this direction has not been carried out at all and the issue of growing forest crops from PMZK remains completely unstudied. In this regard, three options for creating forest crops on terraces using planting material with closed roots were tested:

- Plants were planted in holes measuring 30x30x40 cm using the generally accepted method, with the plants being deepened into the soil so that the root collar was on the soil surface.

- Plants were planted in holes of the same size, with the plants being deepened so that the root collar was 20 cm below the soil surface, into the resulting hole. In this case, the root systems of the seedlings end up in deeper soil horizons with increased humidity compared to the upper horizons (in July–August, the humidity at a depth of 20–35 cm was 2–3% higher than in the 0–20 cm horizon).

- planting of plants is similar to the first option, but an artificial soil structure former is added to the soil into which the root system is embedded - a linear colloid carboxymethyl cellulose (CMC), which has the property of swelling strongly from exposure to moisture and retaining it, preventing physical evaporation. The CMC application rate is taken as the average of those recommended in the literature - 0.02% [2]. In terms of the dry mass of the soil of a planting hole measuring 30x30x40 cm, this amounted to 50-52 g of dry CMC powder.

The soil was prepared in narrow, 1.0 m wide, stepped terraces [5], made by hand. Planting was carried out at the end of March, as soon as the soil dried out after the snow melted. Observations of the survival rate and growth of the planted crops were carried out over the course of two years.

Results and discussion. Observations of the survival rate of the planted plants (figure) showed that pine seedlings with a closed root system have a better survival rate compared to seedlings with open roots (control) already in the first year after planting. Beginning in June, there was an intensive loss of plants in the control, from 80% survival rate to 16%. By the end of the growing season, the survival rate in this variant was 6.7%. In the second year after planting, the survival rate in this variant continued to decrease, and by August all the plants had died.

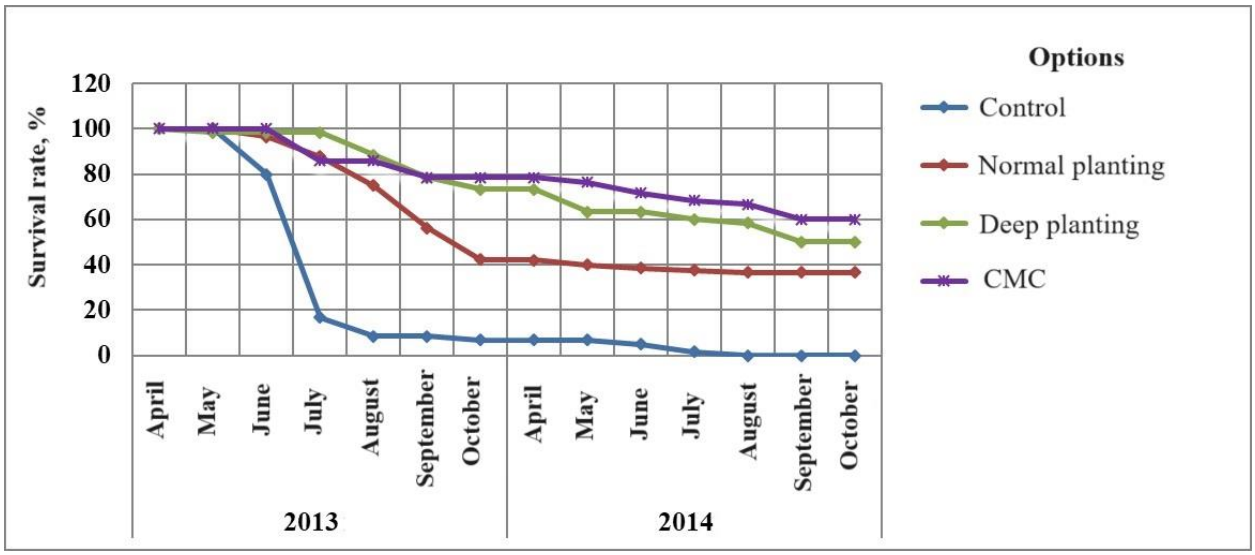

Figure 1. Dynamics of survival of Crimean pine seedlings during the vegetation periods of 2013-2014,%

The survival rate of crops created using closed-root planting material varied depending on the experimental variants. When planting seedlings with the root collar at the soil surface level (normal planting), the first year saw a greater loss of plants than in other variants, starting in July, and by the end of the growing season, the survival rate of pine trees was 42.2%. In the second year, there was still a slight loss, and by the end of the growing season, the survival rate was 36.7%.

The best survival rates in the first year were in the variants with deep planting, when the root system of the plants was in deeper soil horizons, as well as with the addition of CMC-0.2% colloid to the soil. By the end of the first year, the survival rate in these variants was 73.4 - 80.0%. In the second year, by the end of the growing season, in both variants, there was a loss of 13.4 and 6.7% and the survival rate was 50 and 60%. A decrease in the survival rate of pine plantings in the winter period, in the variants with deep planting from 73.4 to 64% and in the variant with CMC from 80 to 68.6% occurred due to damage to the root systems by rodents.

The study of the growth of young pine forest plantations in height (table) showed that on the southern slope in 2013, the year of planting, pine plants with closed roots in all variants continued active growth in height from April to June. Their height during the vegetation period increased by 4.3-4.8 cm in all variants, differing insignificantly from each other. In terms of annual increments, the best growth was observed when planting with the use of CMC. Plant growth in this variant was 10-19% greater than in other planting variants with PMZK with an increase in growth intensity to 89%.

Whereas in the control variant the annual plant growths were 52-71% lower than in the variants with PMZK. The pine planted in this variant practically did not grow in height. In the second year after planting, active growth in height, in the variants with PMZK, although it continued from April to August, was weaker than in the first year and amounted to 1.4 cm in the variant with CMC to 4.0 cm in a year with deep planting, which can be explained by the weak accumulation of nutrients in plants over the previous year in harsh environmental conditions and weakening of nutrition due to the emergence of growing roots beyond the soil substrate located in the containers.

Table 1. Dynamics of growth of Crimean pine PMZK seedlings in height in experimental forest plantations on the southern slope during the vegetation period of 2013-2014.

Options	2013 year					
	April	May	June	July	August	Annual growth, %
	M±m	M±m	M±m	M±m	M±m	
Normal planting (ZKS)	6,1±0,19	8,7±0,47	10,4±0,46	10,9±0,50	10,9±0,58	79
Deep-seated planting (DSL)	6,1±0,20	8,2±0,40	10,4±0,50	10,4±0,54	10,4±0,49	70
Planting with KMC (ZKS)	5,3±0,36	8,0±0,83	9,4±0,86	10,0±0,91	10,0±0,81	89
Control (OKS)	5,6±0,18	5,6±0,17	5,7±0,23	6,4±0,58	6,6±0,81	18
2014 year						
Normal planting (ZKS)	11,6±0,56	13,0±0,55	14,0 ±0,73	14,1±0,79	14,7±0,88	27
Deep-seated planting (DSL)	10,4±0,58	12,5±0,61	14,3±0,89	14,3±0,88	14,4±1,01	38
Planting with KMC (ZKS)	10,0±0,96	10,5±0,91	11,0±1,18	11,1±1,30	11,4±1,02	14
Control (OKS)	7,3±0,91	7,5±1,32	8,0±1,53	-	-	-

Conclusions. Thus, the creation of forest crops with one-year-old pine seedlings grown in containers in the conditions of the continental climate on the slopes of the Chatkal Range ensured in the second year with deep planting or with the addition of CMC colloid to the soil the survival rate in the most severe conditions on the southern slope was 50-60%, whereas

when planting seedlings with open roots the crops perished completely. In these same variants, the best growth of pine plants was also observed.

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