# New methods of planting from the two years forest seedlings with closed root system on the western slopes of the Chatkal range in Uzbekistan

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***Abstract:*** *The article presents the results of experiments on the study of the survival of forest seedlings of four species grown with a closed root system with different methods of planting on the western slope of the Chatkal range, where the forest growing conditions were very hard and arid. The results of the research showed that the highest survival rate of forest seedlings on the western slope was provided by planting with a closed root system with a different method of planting. In the Crimean pine, the best survival rate was observed with deep planting and planting with the use of carboxyl methylcellulose (CMC), where the survival rate of seedlings at the end of vegetation was 86.0-80.0%, respectively. In oak, the best survival rate was provided by planting with the addition of CMC-84.0% colloid to the soil poured into the pit. In Korolkov Hawthorn, a higher survival rate was ensured, in particular, by deepening and planting with application of CMC. At the same time, the survival rate was 98.0-96.0%, which was 10-14% higher than in other variants.*

***Key Words:*** *Woodiness, PMCRS, carboxyl methylcellulose (CMC), substrate, polyethylene containers, plant decay, plant survival, physical evaporation, wilting humidity, ordinary and in-depth planting of seedlings, root layers of soil, atmospheric precipitation.*

## 1. INTRODUCTION:

Currently, the forested area of Uzbekistan's mountainous areas is very low, only 3.0% of the total territory of the country [1]. The effectiveness of reforestation using planting material with an open root system grown in nurseries is not satisfactory. The survival rate of forest seedlings created by such planting material does not exceed 45-50% [2]. One of the main reasons for this is the extreme aridity of the climate, when high temperatures are observed in the midlands in summer conditions, above 350C air temperature and the absence of precipitation. In addition, overgrazing of livestock on the mountain slopes, as well as illegal cutting of mountain forests, which have been observed recently, have led to the denudation and desiccation of the soil cover of the territories.

In summer, only 4% of the annual rainfall rate falls on the slopes [3], which in most cases leads to a large loss or destruction of forest cultures planted with an open root system.

Therefore, in order to increase the survival of forest plantations in the mountains, we conducted experiments to test the methods of Planting Material with Closed Root System (PMCRS). Two-year old seedlings of four forest species were tested in the experiment: pine, Crimean oak, Korolkov hawthorn and Siversi apple, grown in polyethylene containers measuring 25x17 cm in a substrate consisting of 55% of forest soil, 15% of manure and 30% of river sand. Experience is laid on the slopes of the western extremity of the Chatkal range at an altitude of 1400 m above sea level (Figure-1). This slope is characterized by severe forest-growing conditions.

*Figure- 1. General view of the pilot area*

Soil slopes refer to brown typical loess like loam, medium fertile. More than 840 mm of precipitation fell in the year of the creation of experimental forest cultures, but in the summer, the most stressful period, only 29 mm fell out, which played no positive role, since only the surface of the soil was wetted and immediately evaporated. During this period, the humidity of the upper horizons of the soil dropped below the wilting point [3, 2].

## 2. MATERIALS AND METHODS:

In the experiment, for the first time, three different ways of planting seedlings of forest cultures with closed roots in pits with a size of 30 x 30 x 40 cm were tested:

1-variant: - landing in such a way that the root neck was on the surface of the soil;

2-variant: - planting as in the first variant, but in the soil, which was planted during planting, an artificial soil structure was added - a powder of linear colloid – carboxyl methyl cellulose (CMC), which is able to absorb moisture in large quantities and keep it from physical evaporation, keeping for the supply of seedlings, in an amount of 0,02% of the mass of the soil, which is filled with a pit;

3-variant: - planting so that the whole plant is in the hole, where the root neck was below the surface of the soil by 20 cm and thus the root system fell into deeper and, accordingly, more humid horizons of the soil.

As a control, the usual method of planting two-year-old seedlings of open-root forest cultures taken from the nursery was tested, which is used in industry.

Landing is made on terraces with a width of 1 m, created manually. The distance between the terraces along the slope was 3 - 4 m. The slope of the slope is -250. The planting time is the end of March, as soon as the soil has dried out after the snow has melted. To study the dynamics of plant survival and growth in 2014 during the growing season immediately after planting and in the middle of each month, a continuous counting of living plants was carried out.

The results of the studies are given in Figures 2,3,4,5.

## 3. RESULTS AND DISCUSSIONS:

The study of the survival of two-year-old forest seedlings planted on the western slope showed that seedlings with a closed root system had a higher survival rate than a conventional planting with an open root system.

In pine, the largest survivability was observed with deep planting and planting with the use of carboxyl methyl cellulose (CMC), where the survival rate of seedlings at the end of vegetation was 86,0-80,0% (Fig. 2), respectively. This was promoted by the increased soil moisture in the root layer of the soil due to the location of the root systems in the deeper and correspondingly more humid soil layers in the first case and a significant decrease in evaporation of moisture with the use of a moisture-containing colloid (CMC) in the second. The study of soil moisture showed that in case of deep planting, the humidity in the root zone exceeded the wilting moisture by 1,2-2,2% (wilting moisture content was 8%). This contributed to the provision of affordable moisture to plants. The CMC application allowed to increase soil moisture in the root layer by 2-3% due to the retention of moisture by the helium substrate formed during the CMC swelling.

During the usual planting, the survival rate was 78,0%, whereas in the control variant it was 16,0%, which was 4,9-5,3 times lower when compared with other variants. The significant decay of plants on this variant began already from the first decade of June (by 34%). The main reason for this was a sharp decrease in soil moisture in the root layer of the soil in the middle of the summer period below the wilting point.

In oak trees, the largest survivability was observed when planted using CMC-84.0%. When comparing the remaining options with a closed and open root system, it was 1,16-1,4 times higher. A good survival of the seedlings was also observed on a variant with a normal planting. At the end of the vegetative period, the plant survival rate on the variant with the usual planting averaged -72,0% (Fig. 3).

In-depth planting of PMCRS and planting with a bare root system (control) showed the same survival rate of 60,0%. A significant decay of plants was observed already in the middle of summer when planting with naked roots (control). On this variant, a large decline began already from the first decade of July (by 28%). Increased survival rates for variants using CMC can be explained by an increase in soil moisture in the root layer of the soil by 2-3% than the wilting moisture, while in the control it fell down in July to a depth of 50 cm below the wilting point.

In the Korolkov Hawthorn all the options for planting PMCRS showed a good survival rate. But among the options, a better survival rate was ensured, in particular, by deepening and landing using CMC. At the same time, the survival rate was 98,0-96,0%, which was 10-14% higher than in other variants. Regular planting of PMCRS and planting of seedlings with renewed roots (control) showed a close survival rate of 88,0-84,0% (Figure-4).

In the Siversa apple tree, when two-year-old seedlings were planted, against the background of the general relatively better survival rate, it turned out to be in the variants with a deeper planting and with the addition of CMM-92,0-94,0%, respectively, into the colloidal soil poured into the holes. Plant survival in the variants with a normal planting averaged -78,0%, whereas on the control variant it was 64,0%. The significant decay of plants on this variant was observed in the first decade of August-30. Whereas, on variants with a closed root system, it amounted,

**The dynamics of survival of two-year-old forest seedlings with a closed root system planted on the western slope of the Chatkal range**

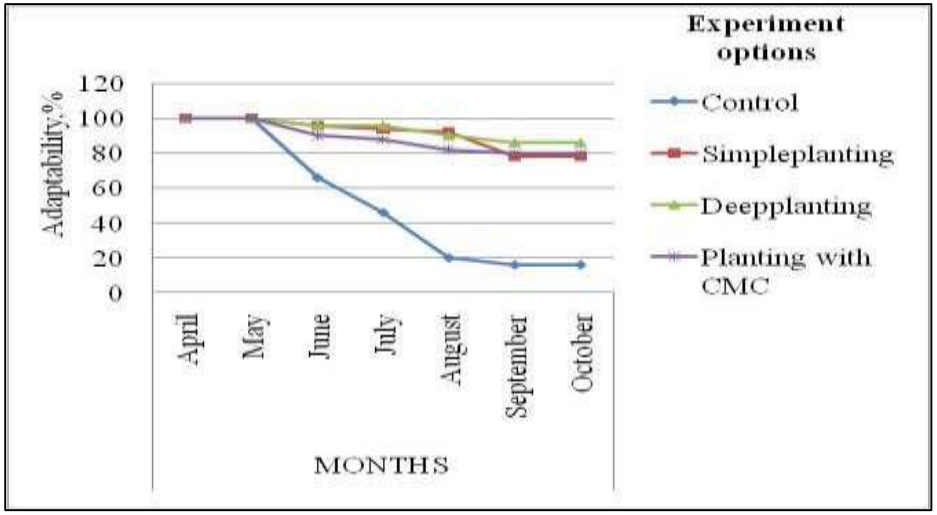


**Figure-2.** The survival of seedlings of the Crimean pine

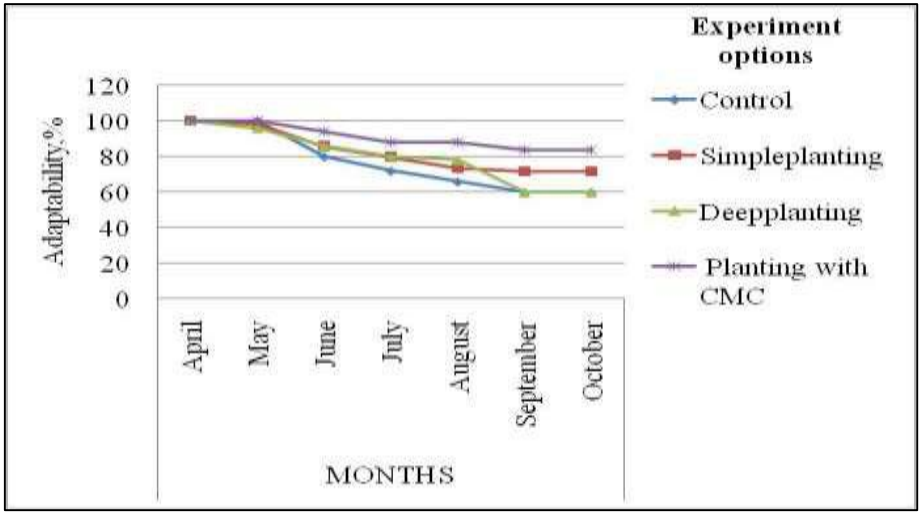


**Figure-3.** Survival of oak seedlings

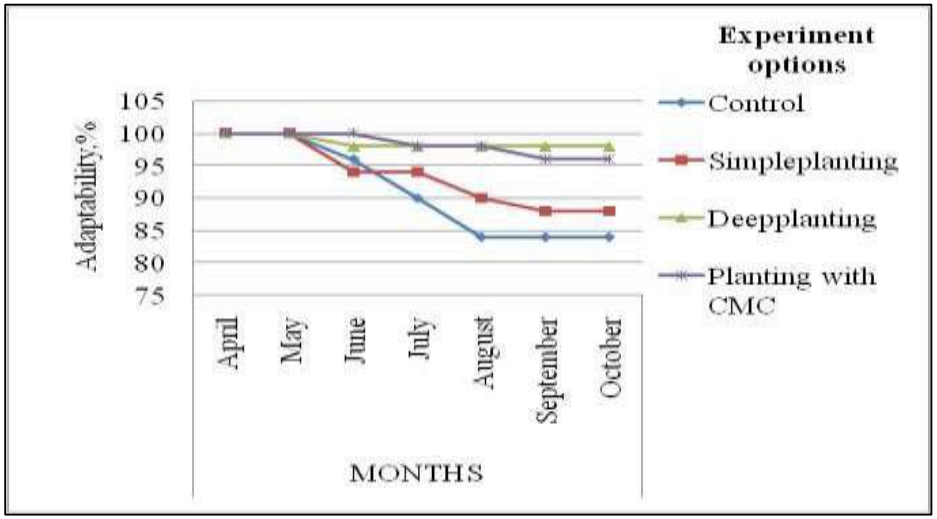


**Figure-4**. The survival of the Korolkov Hawthorn

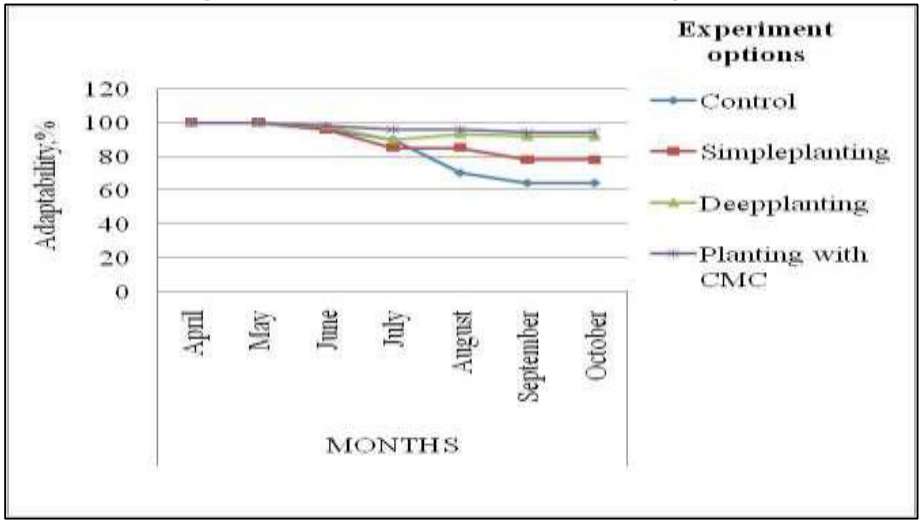


**Figure-5**. Saplings apple tree survival

respectively, to 15-6,6%. Increased survival rates in the options for embedment deepened and using CMC contributed to an increase in soil moisture in the summer in the horizons where the roots of the seedlings (50-55 cm) were for the reasons described above (Figure 5).

## 4. CONCLUSION:

Thus, from the results of the research we can conclude the following:

**1.** When planting two-year-old saplings of Crimean pine with a closed root system on the western slope, a high survival rate is ensured by a deep planting and with the addition of colloid fossa of CMC into the soil, at which it was 86,0-80,0%;

- A good survival of pine seedlings can also be ensured by the usual planting of PPSA, at which it was 78,0%;
- Planting of Crimean pine seedlings with an open root system (control) ensured at the end of the growing season only 16,0% of the survival rate;

**2.** In the case of oak, the largest survivability was provided by the planting of seedlings with the addition of colloid of CMC added to the soil of the CMC that had fallen into the pit, which allowed to obtain an adhesion rate of 84,0%, by keeping moisture in the root layer of the soil 2-3% higher than the helium substrate formed by swelling CMC, which prevented the physical evaporation of soil moisture;

- The usual planting of oak seedlings with a closed root system also ensured a high survival rate of 72,0%;
- Deepening of the planting of the paracental oak cherry tree ensured the same survival rate with the open root system, where it was 60,0%;

**3.** In the Korolkov Hawthorn, the highest survival rate ensured, as in the case of pine, a deepened and planted with CMC application, where it was 98,0-96,0%, which was 10-14% higher than the other variants;

- The usual landing of the PMCRSKorolkov hawthorn showed a close survival rate with seedlings with an open root system, where it was 88,0-84,0%, respectively;

**4.** In the two-year PMCRSof the Sivers apple tree, the highest survival rate was also deepened and planted using a colloid CMC, at which it was 92,0-94,0%, respectively;

-The usual planting of seedlings with a closed root system can also provide a good survival rate of 78,0%;

-The planting of two-year-old apple seedlings with an open root system ensured the survival rate in the range of 64,0%. Large decay of plants on this variant was observed in the first decade of August (by 30%).

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