

New Technology of Container Seedling Afforestation of *Pinus Sylvestris* Var. *Mongolica* Litv in Horqin Sandy Land

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Abstract: A new set of techniques of container seedling afforestation of *pinus sylvestris* var. *mongolica* Litv was summarized through the actual work experience, and the preservation rate of *pinus sylvestris* var. *mongolica* Litv was increased from 50% to over 90%. The cost of afforestation was reduced by 44.1%, which saved a lot of manpower, material and financial resources.

1. Introduction

The Horqin Zuoyihou Banner is located at the southern end of Horqin Sandy Land. The geographical position is about 42°41'~45°15' north latitude, 118°25'~123°30' east longitude, the total land area is 11476 square kilometers and the average annual precipitation is 350~400mm, the average evaporation is about 2000mm, and the annual average temperature is 6.0°C. Starting from 1980s, with the implementation of the construction of the Three-North Shelterbelt System, the whole banner has created many low-cost and is a fast-growing poplar forests. The afforestation of poplar forests is relatively fast which has rapidly increased the forest coverage rate and has significantly improved the ecological environment and also achieved a benign reversal of desertification land. However, as the Yangshuchun forest gradually entered the stage of mature forest which gradually highlighted the shortcomings such as the weakening of trees and also reduced the stress resistance, single ecosystem and decreased land productivity.

Pinus sylvestris var. *mongolica* Litv. is a geographical variant of European red pine, also known as Hailarong, Mongolian red pine which belongs to the Pinaceae and *Pinus*, with the natural distribution areas in Daxinganling and Inner Mongolia Hulunbeier. The distribution latitude is approximately 47° ~ 54° north latitude, it is a precious tree species unique to the northern forest areas of China, in order to improve the quality of the forest in the area and improve the “two rates” of *pinus sylvestris* var. *mongolica* Litv in the region, the author is in the actual production practices at the grassroots level which summarizes the new technology of *pinus sylvestris* var. *mongolica* Litv container seedling to provides reference for the construction of *pinus sylvestris* var. *mongolica* Litv forest in Horqin Sandy Land.

2. Selecting seedlings and starting points

2.1 Seedling specifications and soil requirements.

The Seedling height: 100cm~180cm; rhizome: 1.5cm~3.5cm; crown diameter: 40cm~60cm; 4~8 rounds above the ground above 10cm is the best, the wheel pitch is 10cm~20cm, the diameter of the nutrition cup is 21cm~30cm, and the time for changing the nutrition cup is less than three years, the main root is not the best outside the nutrition cup.

The Nutritional cup soil quality: The nutritional cup soil quality is the best for peat soil which is next to black clay or yellow clay and there no sticky sand or sandy loam is selected.

2.2 Seedling time

There is no growth point or a certain degree of new growth point in the seedlings, the seedlings with a growth point of 6 cm or less are the best and the seedling time of the Horqin Zuoyihou

Banner is from March 15 to May 10.

2.3 Seedling technology

Five days before the seedlings, the water is poured once so that (the seedlings can start without watering it before April 15). The key link of the seedlings is that the soil of the nutrition cup is not deformed and the 40cm long special seedling iron shovel is used for manual excavation or small forklift. Miao is to ensure that there is no more or less damage to the roots of the seedlings.

2.4 Transportation seedling technology

The seedlings should not be backlogged, and the crowns of the seedlings should be arranged obliquely backwards. The shaded nets should be covered (the shaded nets must be tight and not loose), and the water should be moisturized. When the seedlings are loaded and unloaded, the nutrition cups cannot be collided and handled gently.

3. Fake seedling technology

3.1 The Advantages of fake seedlings

3.1.1 The Roots of seedlings

During the seedling or transportation process, the soil quality of the seedling nutrient cup is affected by deformation, and the seedling roots are damaged or some of the roots are cut off, etc., and the injured part can be healed through the fake seedling.

3.1.2 Replenishing moisture

The seedlings loses its physiological water during a winter dormancy process and also loses a lot of water during transportation. After being planted directly without planting, the soil moisture absorption rate of the nutrient cup and the water absorption speed of the sand in the afforestation ground are different and the seedlings cannot get sufficient water leading to the impact of seedling survival.

3.2 The fake seedlings time limit

The time limit for the nursery seedlings of the nutrition cup is related to the weather temperature, because generally, the time limit for the ungerminated seedlings before May 1 can be 7 to 10 days and after May 1st, the seedlings of the growth point have 5 to 7 days to prevent the fake planting water, the excessive time causes the seedlings to peel off the phloem or decay the roots.

3.3 Selection of fake sites

If you choose irrigation conditions near the afforestation site you also have to choose a sheltered area with shelter forests that is low terrain and leeward, mainly to avoid the seedlings being blown dry by the wind thereby affecting the soil etc., the width of the artificial planting groove is about 2~3m, and the length can reach up to 20~40m. A distance of 2 to 3 m is reserved between the two artificial planting grooves to ensure air permeability and the inner layer of the dummy planting is covered with a thick plastic film, the depth of the groove is preferably 40 cm.

3.4 The fake seedling technology

In the nutrient cup, the pine seedlings of the seedlings are filled with a small amount of rooting powder and 8% carbendazim after being placed on the plastic film in the dummy planting tank. Finally, the artificial planting tank is filled with water in the fake seedling trough before May 1st, the first injection of water can be retained for 3 days, after 3 days, the water in the trough is re-injected into the cold water (the seedlings are prematurely activated after the water is heated by the sun). The second water injection can be discharged according to the temperature of the weather and injected into the cold water when the weather temperature is above 20 °C, it is guaranteed to change the water once a day, and the seedling soaking water standard is that the seedlings absorb

much moisture until they reach their fullness. After May 1st, the seedlings with the growth point and the water injection will ensure that the seedlings are twice a day and (the growth of the seedlings stops or inhibits growth during the pseudo-planting period).

4. Precautions for secondary seedling and transportation loading and unloading seedlings

4.1 Secondary seedlings and loading and unloading seedlings

When the fake seedlings are transported to the planting site, there should be two precautions: First, the soil of the soaked seedling container is in a muddy state, after draining the water in the tank, it will takes 1 to 2 days to load and transport to the Yulin pit. Second, loading and unloading when the seedlings are in the seedlings point, they must not collide with the growth point and the soil of the deformed nutrient cup ensuring light handling.

4.2 Secondary the transportation seedling technology

When you the use seedlings for agricultural tricycles or four-wheelers, the Seedlings should not be backlogged, it should be placed neatly and the seedlings should also stand upright, so that during the short-distance transportation, the seedlings will not fall from the car.

5. The planting technical points

5.1 Selection of planting locations.

The selection of the planting location of *Pinus sylvestris* var. *mongolica* generally has a certain degree of vegetation coverage, which is better to fix the sand dunes without sand and it is not suitable for the tuyere, sorghum tip, Mingsha, saline-alkali land or low-lying land that is easy to accumulate water.

5.2 Planting time

The spring afforestation in Horqin Sandy is generally from March 15 to May 1 for the spring afforestation season. The afforestation time of *Pinus sylvestris* var. *mongolica* can be extended to May 20. But the transplanting time of the seedlings is due to the time of soaking water in the seedlings, and the water is raised for 1 to 2 days and after the water is discharged, the soil of the nutrient cup is hardened which can also be planted. When the planting operation is long, the unplanted fake seedlings can be injected with a small amount of cold water to ensure that the seedlings do not lose its water and the fake seedlings are planted with the seedlings, and the seedlings from the fake planting site should not be exposed to the sun in order to prevent the water loss.

5.3 Yulin Pit Specifications

In recent years, the afforestation technology of *Pinus sylvestris* var. *mongolica* has summarized the successful technology of “deep planting and shallow burial”, the advantages of “deep planting” technology are as follows: First, preventing or reducing the swaying of the aerial parts of the seedlings which leads to the failure of the roots and causes new infections. The second is that the sand grains in the Horqin Sandy Land are coarse and the soil moisture evaporates quickly which is not guaranteed; in order to reduce the water evaporation after the seedlings are watered, there is need for deep planting techniques to be adopted. The advantages of the “shallow burial” technology mainly considered that, the watering pit is made below the ground and the water is also prevented from flowing out and to make sure the water is not wasted so that the water can penetrate into the root of the seedling.

The Yulin pit is a large pit with a length, width and depth of about 80×80×80cm. It is best to use excavators to dig and plant pits so that, the size of the Yulin pit can be based on the height of the seedlings, The length, width and depth of the seedlings below 1.5m can be 60×60×60cm.

5.4 Planting depth

The planting depth is generally 40~50cm, which is the best after the seedlings stand in the Yulin pit, cut off the nutrient cup with scissors, then after cutting 4~6 times from top to bottom, push the nutrition cup down back to the bottom, do not destroy the nutrient soil, and do not also step on the ground for the first time watering, the water will all ooze down and then correct the seedlings. After a small amount of backfilling, you will have to step on it, and the distance between the backfilled soil and the ground is guaranteed to be 30-40 cm (water tank).

5.5 The pole technology

If the planting location is a tuyere, the shelf can be considered, but the height of the aerial part of the seedlings after planting does not exceed 160 cm. The length of the shelf is generally the same as the height of the upper part of the seedlings and generally, a seedling requires 3 to 4 racks.

5.6 The irrigation technology

After planting the seedlings, the interval between the first three waterings is 5-7 days, and the subsequent watering interval can be adjusted according to the demand.

5.7 Weeding soil

In July and August of the same year, the turfgrass loose soil was carried out once, the depth of tending was 5-10 cm, and the diameter of the tending was about 100-200 cm (the weeds in other areas were not cleaned); the second year was in June and August. Raise once; in the third year, raise it once in June.5 “Two rates” and comparative analysis of afforestation costs

6. Comparative analysis of “two rates” and afforestation costs

The new afforestation cost of the *Pinus sylvestris* var. *mongolica* seedlings will be compared with the previous afforestation costs and survival rates. See Table 1 and Table 2 for details.

The Comparative analysis of “two rates” of afforestation before and after using the new afforestation techniques

Table1 The Comparative analysis of input costs before and after using the new afforestation technology

afforestation method	same year Point length	Yulin Pit	Seedling height	Nutrition cup Specification	Number of watering			Survival rate	Preservation rate			Need Replanting
					Year1	Year2	Year3		Year1	Year2	Year3	
Before technology	10~30cm	Artificial mining	140~160cm	26~30cm	6	6	6 (replanting seedlings)	50%	75% (after replanting)	85% (after replanting)		Demand
After technology	20~50cm	Mechanical hook Machine mining	140~160cm	26~30cm	6	3	0	98%	95%	90%		No demand

Table2 Yuan, Yuan/hole, Yuan/plant, Yuan/Mu

afforestation method	Yulin Pit Digging		Survival rate (%)			Replanting labor costs				Watering times and costs						Seedling fee	Planting fee	Total cost
			Year 1	Year 2	Year 3	Year 1	Year 2	Year 3	Replanting seedlings	Year1		Year2		Year2				
										frequency	cost	frequency	cost	frequency	Cost			
Before technology	Single pit	2.5					2.0	2			1.5		1.5		2.0	20	2	
	Mu	82.5	50	75	85	/	30	16	460	6	297	6	297	6	276	660	66.0	2184.5
After technology	Single pit	1.5									1.5		1.5			20	2	
	Mu	49.5	98	95	90	/	/	/		6	297	3	148.5			660	66.0	1221.0

According to the actual data analysis, before the application of the new technology of *Pinus sylvestris* var. *mongolica*, the survival rate and the preservation rate of *Pinus sylvestris* var. *mongolica* in the spring were all below 50%, and after applying the new technology of *Pinus sylvestris* var. *mongolica*, the survival and preservation rate of more than 90% were improved, and the growth become more strong. The cost of afforestation can be reduced by 44.1%, and the number of watering is also reduced by 50%, and water resources are saved by 55.8%.

7. Conclusion

After a survey of the forest land of *Pinus sylvestris* var. *mongolica* in the past decade, it was discovered that the survival and the preservation rate of *Pinus sylvestris* var. *mongolica* were low and the preservation rate in the third year was over 50%. The main reason is that, the spring wind is very dry and the temperature is low which makes the newly planted seedlings have slow water absorption, slow seedling period and serious water loss on the ground. The new technology of *Pinus sylvestris* var. *mongolica* has also solved the technical problems of spring afforestation well about the technique of “deeping big pit”, “deep planting shallow burying” and “soaking seedlings” can rapidly increase the ground temperature when you soak the roots of seedlings through water and cultivate the water fully. The seedlings are shortened and the survival time is good for the years of practice have also proved that the application of the new technology of *Pinus sylvestris* container seedling afforestation can increase the survival rate of the seedlings of the scorpion seedlings in the spring to more than 98%, and the preservation rate in the third year will also increase to over 90%, and the growth will be stronger. Planting and rebuilding links and significantly reducing the cost of afforestation in the area of Yilin Land and Horqin Sandy Land is large, and large-scale low-yield for the forest will needs to be reconstructed. It is therefore necessary to adopt the method of “planting needles and widening” to transform low-yield forests according to the local conditions and vigorously promote the application of “New Technology of *Pinus sylvestris* Container Seedlings Afforestation” which plays an important role in improving the quality of ecological construction in Horqin Sandy Land.

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