Study on Cultivation Technology of Larix gmelinii in Ziwuling Forest Region

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Abstract: Larix principis is an excellent cultivated tree species in northern China, which has been introduced and grown well in Ziwuling forest region. However, the seedling survival rate will be affected by the frequent occurrence of seedling blight. The seedling differentiation is prominent, so the seedling specifications are different. Although Larix principis sprouts early, the afforestation season is short. So the survival rate is low. In view of the above problems, this paper discussed the cultivation techniques under similar climatic conditions.

1. Introduction

Larix gmelinii is a larch tree of Pinaceae family. Its height can reach 30m and DBH can reach 1m. It is the main tree species in the coniferous forest belt of North China. Its tree shape is graceful, dignified and upright, good material quality, wide distribution, high ecological and economic value, and so on. Our country should develop cultivation and extension techniques for fine tree species resources, which will expand the number of population resources. It is of great significance to provide high-quality forest products, optimize stand structure and cultivate multi-functional forest resources for the society.

2. General situation of test area

The experimental site is located in Donghuachi Forest Farm of Ziwuling Forest Area, which is in the hinterland of Ziwuling Forest Area. The area belongs to the hilly and gully landform of the Loess Plateau, with an elevation of 1110-1780 m and a relative height difference of 200 m. The climate is temperate continental monsoon climate, with an average annual temperature of 8.4 C, extreme high temperature of 38 C and extreme low temperature of - 26.5 C. The annual frost-free period is 165 days, the annual rainfall is 480 mm, and the annual evaporation is 1500 mm. The soil types in this area are grey cinnamon soil, loess soil and black loess soil. The area has deep soil, fertile soil, loose texture and good permeability, which is suitable for forest growth.

3. Test contents and methods

3.1 TEST DESIGn

In this paper, seeds were treated by three different methods: warm water germination, sand storage and snow storage, and then the resistance of seedlings was studied. In this experiment, three kinds of seedling cultivation methods were used, including high-bed seedling cultivation in field, polyethylene nutrition bag and non-woven nutrition bag. Afterwards, the survival rate of afforestation was tested. Two years later, seedlings of different specifications were classified and cultivated. Then, this paper studies the problem of low utilization rate of seedlings. Finally, through the afforestation experiment in spring and autumn, the best afforestation season and time were determined.

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3.2 Selection of test sites

The nursery experimental site is located in the basic nursery of Donghua Chi Forest Farm. The nursery soil is black loess soil, the soil is fertile, its permeability is good, PH value is 7.4. It has irrigation conditions and convenient transportation. The afforestation land is selected in Donghuachi Forest Farm management area. There are suitable barren hills and sparse woodlands. The site types are Liangduo, Shady Slope, Semi-Shady Slope, Sunny Slope and Semi-Sunny Slope.

3.3 Test materials

In this experiment, 60 kg seeds were purchased from Wutai Mountain, Shanxi Province. In this experiment, polyethylene nutrition bags and non-woven nutrition bags were selected, with specifications of 10 *15 cm and quantities of 200,000 each. In addition, the materials needed for seedling raising were selected, such as compound fertilizer, potassium dihydrogen phosphate, plant power 2013, ferrous sulfate, potassium permanganate, decomposed sheep manure, bactericide, carbendazim, Bordeaux liquid, plastic film, bamboo strip, etc.

3.4 Test method

3.4.1 Seed treatment

Before winter, the staff divided the seeds into three parts, each 20 kg. The methods of warm water treatment are as follows. The seeds are dried in winter and selected with clear water in April of the next year. Then the seeds were disinfected with 0.5% potassium permanganate solution for 30 minutes. Next, soak the seeds in warm water at 40 C for 24 hours, then take out the stalls and air them. Workers need to sprinkle water four to five times a day, which will keep the seeds moist. When 30% of the cracks occur, the workers sow the seeds. The other two seeds were selected and disinfected in January. One was mixed with wet sand at a ratio of 1:5 and the other was mixed with snow at a ratio of 1:5. They were piled up in a low-temperature drying room. The seeds were taken out and aired in mid-April. The seeds were sown at 30% of the crack mouth.

3.4.2 Nursery way

In this experiment, three methods were selected: ridge seedling raising in high bed, polyethylene nutrition bag seedling raising and non-woven nutrition bag seedling raising. The specifications of the high bed in the field are 70 cm wide, 18 cm high and 10 m long. In this experiment, the land was made into a 10 m x 10 m border. Walkway and bed level, circular irrigation. Low-bed polyethylene nutrition bag and non-woven nutrition bag were used in this experiment. The bed width is 80 cm, the bed height is 15 cm and the length is 10 m. The nutrient soil is prepared as follows. The ratio of humus to loess is 7:3, adding 5% of mature manure, 3% ferrous sulfate and 2% calcium superphosphate. The staff mixed the nutrient soil evenly and sifted it for bagging. When sowing in the field, the workers first irrigate and then smooth the bed surface. Then the staff opens two seeding ditches along the bed, and the amount of seeds is 12kg/667m2. The plantlets were irrigated with sole water before the nutrient bags were planted. When the soil was not bonded, the planting bags were planted with 4-6 seeds. After planting, small plastic arch shed was built.

3.4.3 Seedling classification

The seedlings were graded in the spring of the third year of seedling cultivation. The height of seedlings was above 30 cm, and they were planted in nurseries. The seedlings were transplanted to bed below 30 cm. Field seedling transplantation was used in this experiment. The plant spacing was 5 cm and the row spacing was 25 cm. In this experiment, nutrient bag transplantation was used, with a bed width of 80 cm, a bed height of 15 cm and a length of 10 m.

3.4.4 Planting season

The experiment was divided into two seasons: spring and autumn. The period of spring planting was from March 10 to April 5, and autumn was from September 20 to October 20. In Ziwuling forest area, the sprouting period of Larix gmelinii seedlings in spring is from March 15 to 20, and

the thawing period of nursery and afforestation soil is generally from March 20 to 25. When Dingling was in spring, the workers began to plant it. When the length of needles is 1 cm after leaf expansion, the planting is over. In autumn, when the needles of the seedlings turn yellow or fall off, the workers plant them. When the soil is frozen for three weeks, the planting is over.

4. Results and analysis

4.1 Analysis of the results of seedling production

In this experiment, three different methods were used to treat seeds, and three 1*1m samples were set up to observe and investigate the emergence, resistance and differentiation of seedlings.

4.1.1 Observation of emergence stage

The results showed that the days of germination in warm water were 22 days, those in sand storage were 18 days, those in snow storage were 15 days. The results showed that the seeds with warm water germinated slowly, and the seeds with snow storage germinated fastest. The experimental results are shown in Table 1.

Table 1: Days of emergence by different seed treatments (d)

Seed processing method	Days of emergence
Warm water accelerates germination	22
Sand storage treatment	18
Snow storage treatment	15

4.1.2 Seedling resistance

The experimental investigation is as follows. The mortality rate of standing blight was 42.6% in the seeds treated by warm water. The mortality rate of standing blight was 28.3% in the seeds treated by sand storage. The mortality rate of standing blight was 22.9% in the seeds treated by snow storage. The results showed that the resistance of seeds germinated in warm water was poor, and that of seeds stored in snow was strong. The experimental results are shown in Table 2.

Table 2: Mortality survey of wilt caused by different seed treatments (%)

Seed processing method	Mortality rate of standing blight
Warm water accelerates germination	42.6
Sand storage treatment	28.3
Snow storage treatment	22.9

4.1.3 Seedling differentiation

The results are as follows. The average seedling height of seeds germinated by warm water was 2.3 cm in that year. The number of seedlings larger than 5 cm accounted for 6.3%, 2-5 cm for 21.4%, and less than 2 cm for 72.3%. The average seedling height of sand-stored seeds was 3.5 cm in that year. The number of seedlings over 5 cm accounted for 12.6%, 2-5 cm for 28.1%, and less than 2 cm for 59.3%. The average seedling height of the seeds treated by snow storage was 3.6 cm in that year. The number of seedlings over 5 cm accounted for 13.9%, 2-5 cm for 35.4%, and less than 2 cm for 50.7%. The results showed that seedling differentiation was serious and the proportion of weak seedlings was large. Sand storage treatment was the second. Seedling differentiation by snow storage treatment was relatively light, and the proportion of weak seedlings was low. The experimental results are shown in Table 2.

The above tests show the following. The seed treatment methods of Larix principis have significant effects on the emergence regularity, seedling resistance and growth process. There was a positive correlation between the emergence rate, resistance and high growth of three different treatments. Therefore, seed treatment method is the key to larch seedling cultivation, which is

related to the quality and success of larch seedling cultivation.

Table 3: Seedling differentiation by different seed treatments

Seed processing method	Average seedling height (cm)	Seedling height above 5cm (%)	Seedling height of 2-5cm (%)	Seedling height less than 2cm (%)
Warm water accelerates germination	2.3	6.3	21.4	72.3
Sand storage treatment	3.5	12.6	28.1	59.3
Snow storage treatment	3.6	13.9	35.4	50.7

4.2 Growth of different nursery ways

Three different seed treatments were used for different seedling raising methods. Three 1*1m samples were set up to observe and investigate the qualified rate of seedlings. According to the types of afforestation sites, three 20*20m plots were set up to investigate the survival rate of afforestation.

4.2.1 Qualified rate of nursery discharge

Larix principis in Ziwuling forest area is generally afforested with 2-year-old seedlings. However, the seedling differentiation is serious and the nursery rate of 2-year-old is low. The primary and secondary seedlings are used for afforestation, and the third grade seedlings should be transferred to bed for re-cultivation. The experimental results are as follows. The average yield of 2-year-old seedlings was 45,000 plants/667 m2, the average height of seedlings was 16.5 cm, and the primary and secondary seedlings only accounted for 28.4%. After three-stage seedlings were transplanted to bed, 21,000 plants/667 M2 were nurseries in 2-3 years, and the qualified rate of nurseries was only 46.7%. The 2-year survival rate of polyethylene nutrition bag and non-woven nutrition bag was 76.3% and 81.4% respectively. The primary and secondary seedlings in 2-years accounted for 33.6% and 31.2% respectively. The qualified rate of nursery emergence was 62.5% and 66.7% respectively. The experimental results are as follows. The high seedling rate and high qualified rate of Larix gmelinii seedlings raised in non-woven nutritional bags are high, but the proportion of primary and secondary seedlings is low. The seedling rate and qualified rate of field nursery are the lowest.

Table 4 Qualification rate of nursery emergence in different nursery ways

Nursery Way	Average seedling yield(10,000 plants/667 m^2)	Seedling conservation rate (%)	Average seedling height (cm)	Primary and secondary seedlings (%)	Nursery pass rate /%
Seedling Raising in Field	4.5	43.2	16.5	28.4	46.7
Polyethylene nutrition bag	11.4	76.3	17.2	33.6	62.5
Non-woven nutrition bag	12.2	81.4	17.9	31.2	66.7

4.2.2 Survival rate of seedling afforestation

2-year-old and 2+1 seedlings were used for afforestation in spring and autumn. Site types can be divided into five types: girder, shady slope, semi-shady slope, sunny slope and semi-sunny slope. In this experiment, 20*20m samples were set for investigation. The experimental results are as follows. In spring, the average survival rate of Bare-rooted seedlings, polyethylene nutrition bag and non-woven nutrition bag were 69.8%, 81.3% and 82.7% respectively. The results are as follows. In autumn, the average survival rate of Bare-rooted seedlings, polyethylene nutrition bag and non-woven nutrition bag were 55.1%, 76.6% and 78.6% respectively. The results are as follows. The survival rate of nude-rooted seedlings in field nursery was low, and that of non-woven nutritional bag seedlings was the highest. Both spring and autumn afforestation of Larix gmelinii Nutrition Bag seedlings ensured the survival rate. The survival rate of bare-root seedlings in autumn

afforestation is not guaranteed.

Table 5: Survival rate of seedling afforestation in different nursery ways (%)

Site type	Nursery Way					
	Seedling Raising in Field		Polyethylene nutrition bag		Non-woven nutrition bag	
	Spring	Autumn	Spring	Autumn	Spring	Autumn
Liang Mao	71.6	66.3	80.4	71.7	79.4	71.5
Shady slope	77.2	69.5	89.8	78.5	91.1	84.6
Semi-shady slope	75.6	64.6	84.3	79.3	85.8	88.1
Sunny slope	61.4	33.7	72.2	75.6	75.6	72.3
Half sunny slope	63.2	41.2	79.8	77.8	81.6	76.3
Average	69.8	55.1	81.3	76.6	82.7	78.6

5. Conclusions

Larix gmelinii has the following characteristics, such as low germination rate of seeds, low germination potential, slow and irregular seedling emergence, susceptible to standing blight, prominent early capping phenomenon, and serious differentiation of seedlings.

Seeds treated with snow storage can have the following advantages, such as accelerating seed germination, growing strong, enhancing disease resistance, prolonging the seedling capping period, significantly improving height growth and reducing seedling differentiation. Therefore, seed treatment method is the key technology of seedling cultivation, and snow storage treatment is a more appropriate treatment method.

Nutrition bags can effectively improve the qualified rate of seedlings. At the same time, it is convenient for second transplantation. Nutrition bags can reduce seedling loss caused by secondary transplantation. Non-woven nutrition bags are pollution-free, and the soil is well ventilated. Therefore, the survival rate of planting is higher.

Larix gmelinii planting has the following characteristics, such as early spring germination, short afforestation season and low survival rate. Nutrition bag seedlings are convenient for afforestation. Before thawing in spring, the frozen soil can still emerge through early irrigation. Afforestation should be carried out on the sunny slope first and then on the shady slope. We can extend the time of afforestation in spring to the end of March before leaf expansion, so the afforestation time is about 15 days, which can better solve some problems, such as early seedling germination, late thawing of soil, short afforestation period, etc. Autumn afforestation can also effectively improve the survival rate. Ziwuling forest area belongs to semi-arid area, and drought is the main factor affecting the survival rate of afforestation. Therefore, breeding seedlings through nutrient bags is of great significance to the afforestation of Larix gmelinii. It can expand the stand area and increase the number of resources.

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