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Meaning of ecological Chinese larch garden breeding on conservation of water and soil and natural forest protection project

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ABSTRACT

Natural forest resource in our country suffers from destruction, which intensifies water and soil loss, enlarges desertification and decreases biodiversity. Thus, the ecological environment deteriorates and the sustainable development of social economy was seriously restricted. Natural forest has unique effect on climate adjustment, natural disaster defense, land ecological security, etc. In order to solve problem of water and soil conservation and protection of natural forest, this paper analyzed the effect of undergrowth coverage on soil and water and soil conservation and studied the limitation of carrying capacity of land on woods. Those provided moderate tree control proportion for ecological restoration, make the ground flora have sufficient illumination and nutrient for growth, and thus better developed the function of water and soil conservation. Then it analyzed the cultivating technology of Chinese larch, which provides theoretical support for the cultivation of ecological Chinese larch garden.

KEYWORDS

Natural forest; Water and soil conservation; Coverage; Carrying capacity; Chinese larch garden.

INTRODUCTION

As a basic national policy insisted for a long time in our country, water and soil conservation is a necessary approach for protection and construction of ecological environment, reasonable use of water resource and promotion for ecology, economy and social sustainable development. Meanwhile, some scholars studied the strategy for water and soil protection as well as natural forest protection project. Zhao Yan, doctor of water and soil conservation and prevention and control of desertification from Beijing Forestry University, introduced the solution for system, method and function of second and third level division in water and soil conservation based on the first level division of national water and soil conservation in Research on Regionalization and Functional Orientation of Water and Soil Conservation[2]. Wang Xin from Northwest Agricultural and Forestry University proposed the scientific measures for environment management for natural forest protection project in Shanxi under the guidance of scientific forestry development theory such as environment management, ecological beauty concept, etc in Research on Environment Management of Natural Forestry Protection Project in Shanxi in the Perspective of "Ecological Beauty"[3].

OVERVIEW

Chinese larch is suitable to grow in region of high cold and dankness. It is feasible to study the breeding technique of it. Chinese larch is deciduous tree and can reach up to 50 m. It loves for light and has good adaptability. It can resistant to high cold and hungry soil and can grow well in hillside with cool climate, deep soil layer and good drainage. It can form stable pure forest or mix with other needle hardwood in ridge in height of 2400~3900 m in Zhuoni, Diebu and Zhouqu. According to the production practice, this paper concluded breeding technique for Chinese larch suitable for high cold and dankness area. It obtained arbor coverage by analyzing the effect of different arbor on water and soil conservation, and then breed's Chinese larch for forestation based on the index.

DATA ANALYSIS ON THE WATER AND SOIL CONSERVATION EFFECT OF DIFFERENT ARBOR COVERAGE

Data analysis of group A1

As we can see from Figure 1, the undergrowth vegetation coverage and total vegetation coverage increased as the increase of arbor coverage. In addition, the coverage of undergrowth vegetation rose form 11.4% to 20.3% and the amplification was 43.8%. The total vegetation coverage rose from 16.3% to 29.8% and the amplification was 45.3%. Moreover, we can know from the figure that when arbor coverage was less than 12%, the undergrowth vegetation coverage and total vegetation coverage had no increase basically; and when the arbor coverage was more than 12%, then the indexes in the figure had obvious growth; the organic content rose from 0.24g/kg to 0.35g/kg and had a growth of 31.4%. As we can see in TABLE 1, the undergrowth coverage and water and soil conservation factor showed polynomial relationship when the undergrowth coverage was between 0-20 %.

TABLE 1 : The relationship between soil and water conservation indexes with arbor coverage

water and soil conservation	indexes relationship	R^2	n
Organic matter	y=0.0638x2-1.2842x+9.0498	0.961	43
Erosion modulus	y=-0.0249x2-0.0357x+11.639	0.982	43
runoff	y=-0.1976x2+3.8616x+34.26	0.941	43

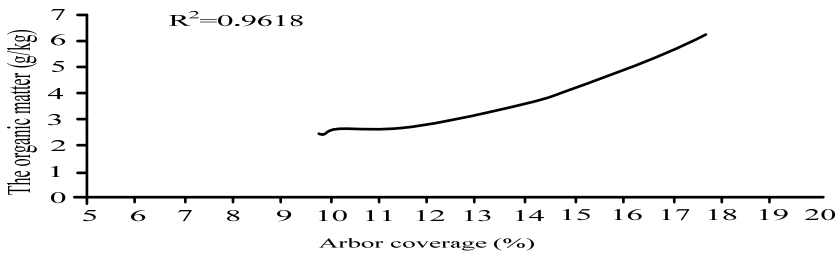

Figure 1 : Scatter diagram of relationship between vegetation coverage and organic matter content in group A1

It can be seen from Figure 2 and 3 that the soil erosion modulus had an obvious decrease; the soil erosion modulus decreased from 8.69 kt/km2 to 3.489kt/km2 and had a decrease of 59.9%; the runoff decreased from 54.5% to 42.3% and had a decrease of 22.4%.

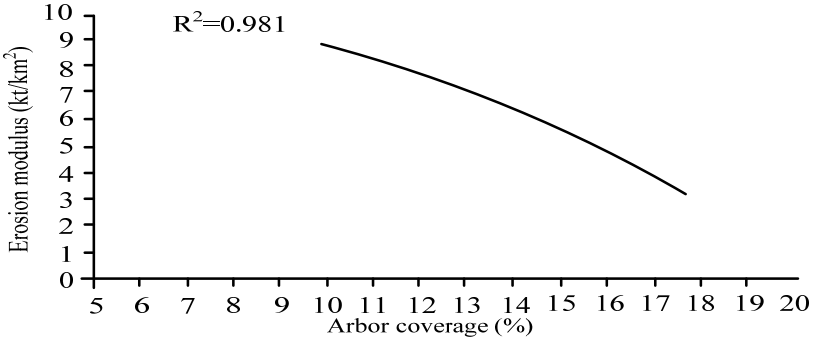

Figure 2 : Scatter diagram of relationship between vegetation coverage and erosion modulus in group A1

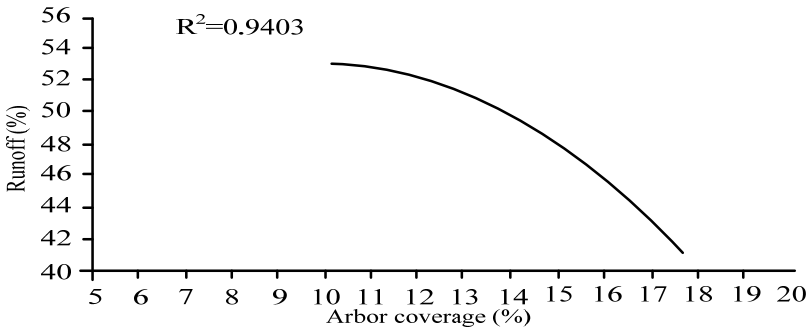

Figure 3 : Scatter diagram of vegetation coverage and runoff in group A1

In conclusion, when the arbor coverage was more than 12%, then the organic matter in the soil had obvious increase, and the soil erosion modulus and runoff had obvious decrease. The fact illustrated that 12% of arbor coverage might be a threshold value for local ecological restoration.

Data analysis of group A2

TABLE 2 : The relationship between soil and water conservation indexes with arbor coverage

water and soil conservation indexes	relationship	R^2	n
Organic matter	$y=0.0091x^2-0.4454x+11.553$	0.939	24
Erosion modulus	$y=0.00219x^2-0.1732x+5.9463$	0.870	24
runoff	$y=70.511x^{-0.177}$	0.878	24

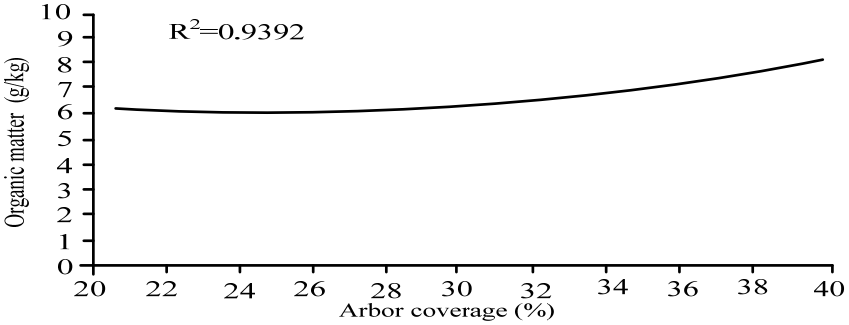

Figure 4 : Scatter diagram of relationship between vegetation coverage and organic matter content in group A2

As we can see from Figure 4, when the arbor coverage was between 20% to 40%, the undergrowth vegetation coverage rose from 21.7% to 54.4% with the increase of arbor coverage and had an amplification of 60.1%; and the total vegetation coverage rose from 33.4% to 81.2% and had an increase of 58.9%. In this process, the organic matter content in soil also had an obvious increase with the increase of arbor vegetation coverage. It rose from 6.04 g/kg to 8.69g/kg and had an increase of 30.5%. TABLE 2 showed that, when the arbor coverage was between 20% to 40%, then the arbor coverage showed exponential relationship with runoff and showed polynomial relationship with other water and soil conservation factors.

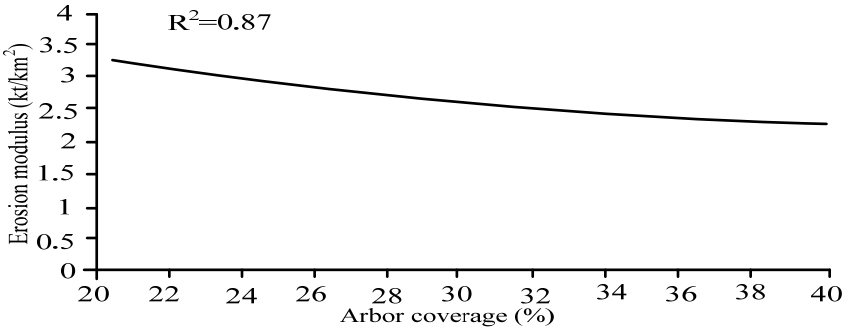

Figure 5 : Scatter diagram of relationship of vegetation coverage and erosion modulus in group A2

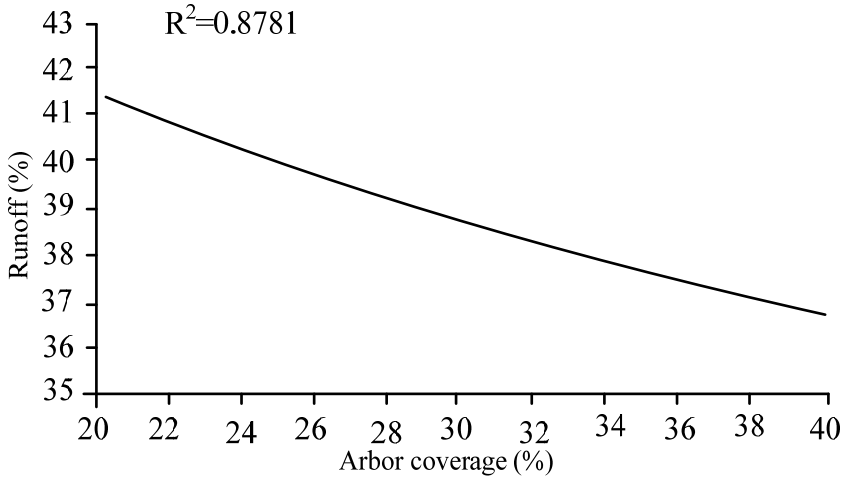

Figure 6 : Scatter diagram of relationship of vegetation coverage and runoff in group A2

As we can see from Figure 5, with the increase of arbor vegetation coverage, the erosion modulus of soil had obvious decrease. It decreased from 3.57 kt/km2 to 2.134kt/km2 with a decrease of 40.2%. Although the decrease amplitude was obvious, the decreasing ratio was lower than group A1. Overland runoff also decreased with the increase of arbor coverage, as shown in Figure 6. It decreased from 42.1% to 36.1% with decreasing amplitude of 14.3%. As we can see from the above data, the increase of arbor coverage can not only improve the content of nutrient in soil but also inhibit water and soil loss.

Data analysis of group A3

TABLE 3

water and soil conservation indexes	relationship	R^2	n
Organic matter	$y=-0.0556x^2+6.2162x-100.07$	0.9338	40
Erosion modulus	$y=-0.001x^3+0.1677x^2-9.1284x+166.89$	0.8908	40

runoff	$y=0.0352x^2-4.1749x+153.06$	0.8829	40

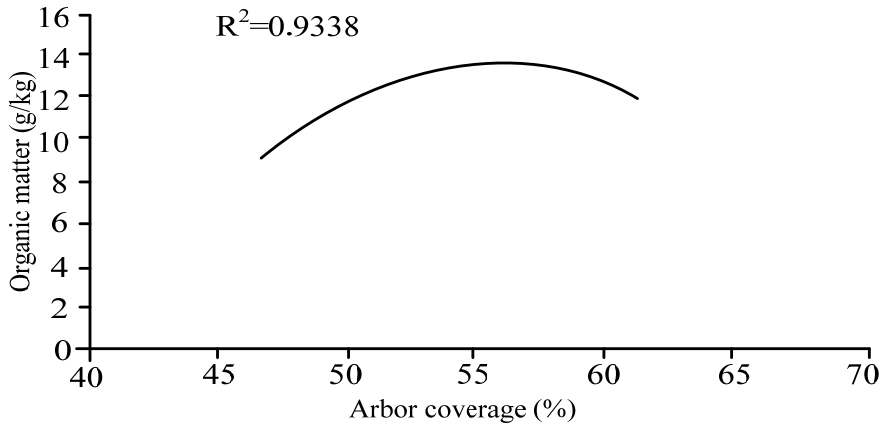

Figure 7 : Scatter diagram of relationship of vegetation coverage and organic matter content in group A2

As we can see from Figure 7, when the arbor coverage was more than 40%, the undergrowth vegetation coverage rose from 55.7% to 70% with the increase of arbor coverage and had increasing amplitude of 20.4%; the total vegetation coverage rose from 83.1% to 100% and had increasing amplitude of 16.9%. As we can see from TABLE 3, when the arbor coverage was more than 40%, then the arbor coverage showed polynomial relationship with water and soil conservation factor.

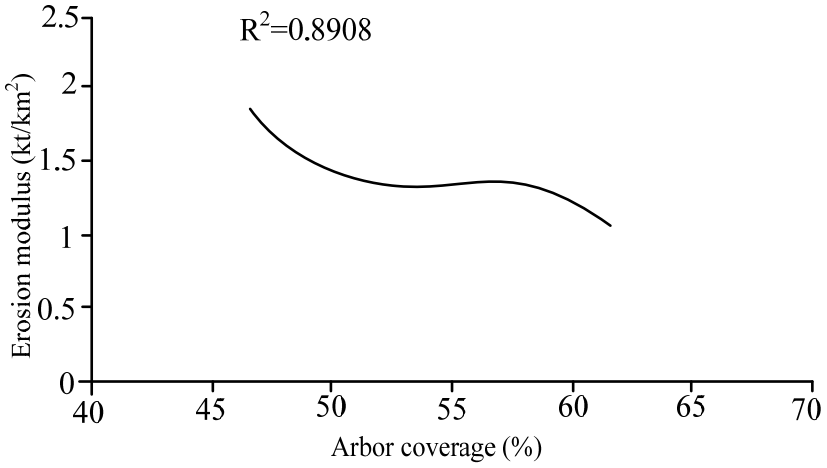

Figure 8 : Scatter diagram of relationship of vegetation coverage and erosion modulus in group A3

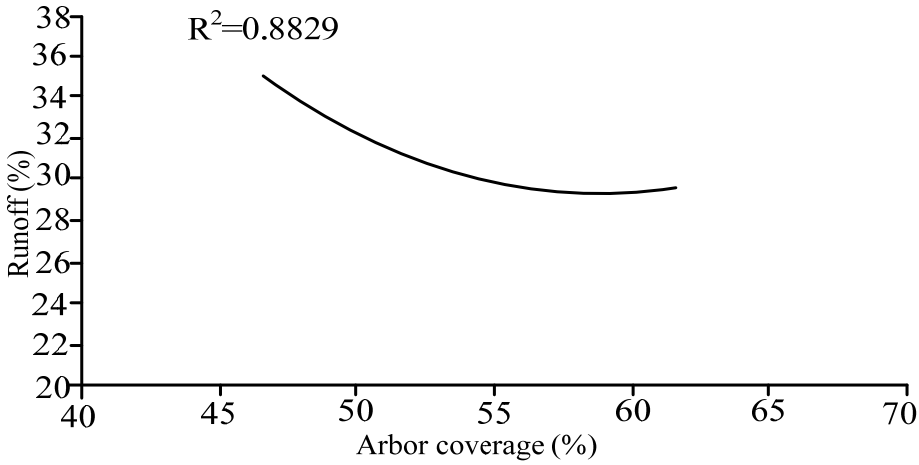

Figure 9 : Scatter diagram of relationship of vegetation coverage and runoff in group A3

As we can see from Figure 8 and 9, the soil erosion modulus and runoff was controlled and constantly decrease with the increase of arbor coverage; the soil erosion modulus decreased from 2.121kt/km2 to 0.995kt/km2 with a decrease of 53.1%; the runoff amount decreased from 37.8% to 28.1% with decreasing amplitude of 25.7%. The two figures showed that the increase of arbor coverage can effectively control water and soil loss.

ECOLOGICAL CHINESE LARCH BREEDING AND FORESTATION TECHNOLOGY

Breeding

(1) Seed collection. Taohe River of Bailong River in Gansu was taken as an example. Seeds of Chinese larch should be collected once the cone is mature. Otherwise, they will be hard to collect because of cracking and flyoff of seeds. In that area, seeds of Chinese larch mostly begin to mature in October. The cone can be collected when they turn form green to dark green, and then from dark green to tawny. The strong trees which grow 20~50 with good form, strong resistance and less plant diseases and insert pests are generally selected as trees for seed collection. The seeds are collected by climbing tree or high branch cutting. If the cones are partially cracking, then tarpaulin or plastic film should be paved under the trees for preventing the seeds flyoff when falling. Cone are placed in a well-ventilated area for airing and stirred one to two times every day. Generally, seeds can all take off the net for 10 d. Then the seeds should be kneaded, dried, cleansed and stored. Generally, the good quality seeds can be more than 95% and the germination rate can be more than 90%.

(2) Seeding bed preparation. We choose land with convenient traffic, open terrain, good capacity of water irrigation and drainage and high soil fertility. The land should be deep ploughing for 20~25 cm 30 d before seeding. And the sundries such as grassroot are picked. The land is ruffled and raked as bed. Then screened forest humus and rotten fertilizer are covered on the land for 60 m3/hm2. According to the local climate, high bed is suitable. Generally, the bed is 20~30 cm high. The width of bed bottom is 110 cm and the wide of bed surface is 100 cm. The width of aisle is 30~40 cm. The land is broadcasted ferrous sulfate for 225~300 kg/hm2 7 d before seeding and 5% phorate granule for 150~225 kg/hm2 for soil disinfection.

(3) Breeding. In spring, we can seeding when the temperature of 5 cm soil is about 9 °C. We conducted sowing in line as primary. The line spacing is 18 cm and the sowing quantity is 120~150 kg/hm2. After seeding, the screened humus soil is covered on the land for about 0.6~0.8 cm and then suppressed. Afterwards, the sterile bamboo curtain splint is covered on the land. Sowing time should avoid rainfall weather and should be fulfilled on the same day as far as possible.

(4) Seeding management. After seeding, bamboo curtain splint is covered on the land timely. After the seeding is fulfilled, sticks are used for supporting bamboo curtain splint and setting up sunshelter. The sunshelter is usually 40~50 cm high. The length and width exceeds 10~20 cm compared to the seedbed for preventing the direct sunlight. On rainy days, when the moisture in soil is saturate, the sunshelter should be uncovered. After the seeding come up, water should be sprayed for cooling timely when the surface temperature is close to 30℃. In order to cultivate strong seeding with developed root to improve the survival rate of forestation, one-year nursery stock needs to be transplanted. The too long axial root and lateral root are cut off when transplanting. The density is maintained at about 1500, 000/ hm2. The nursery stock should water after transplantation. It is best to foresting 2 a after the cultivation in nursery.

(5) Outplanting. Nursery stock of Chinese larch is cultivated in nursery for 2 a. The seeding can out planting when they are more than 30 cm high and with more than 4mm of ground diameter. The seeding are watered for one time 10 d before lifting of seedings to make the seedbed be wet and loose in order to ensure the integrity and no water loss of root system. After lifting of seedings, they are bundled by level and heeled in. They are out planting after moistening slurry and packaging.

Garden cultivation

(1) Reasonable planting. Mixed forestation of Chinese larch, picea purpurea, fir, etc can be adopted because pure forest of Chinese larch have many diseases and pests, large fire danger and bad effect of soil improvement. Usually, whole planting and slit planting are adopted. In whole planting, the surgery stocks are planted in holes according to the spacing between rows and specification of hole. Method of "three buries two stamps and one lifting" is adopted to ensure extending of root system and straight of rod. In slit planting, hoe or shovel is used to slit in planted land. The surgery stocks are put in. Then the tools are pulled out for compression and tread. The root should not be crowded and the depth should be suitable. The density of Chinese forestation can be confirmed according to site conditions and cultivation category. Generally, the spacing between rows is 1.8m×1.8 m and the density is 3 000*3 300 plants /hm2 in initial stage of forestation.

(2) Nurture of young growth. Nurture management precedes for 4 a continuously after forestation, which provides beneficial conditions for the growth of young growth. In first year, weeding is conducted in early June and early and mid August; in second year, weeding is conducted once in early June, and in early and mid August, urea for 30 kg/hm2 is combined with weeding as well as loosing the hole; on third and fourth year, weeding is conducted in early July combined with loosing the soil. Cirrus twine the nursery stock is removed when weeding. Coppice shoot of arbor and shrub which will not hamper young growth should be reserved. Loosing soil should be deeper gradually from inside to outside. Break the soil block, pick the weed and prevent to hurt root. After forestation, the area should strictly ban for human and livestock. Forest protection personnel should patrol the mountain throughout the year. In fire danger season, fire should be strictly banned and the necessary fire fighting equipment should be outfitted.

CONCLUSION

12% of arbor coverage is the threshold for water and soil conservation and ecological restoration[4,5]. When the arbor coverage was less than 12%, the soil nutrients such as organic matter was low and the soil erosion modulus and runoff volume was high. However, when the arbor coverage was more than 12%, the soil nutrients increased with the increase of arbor coverage, and the erosion modulus and runoff volume decreased with the increase of arbor coverage. That was consistent with the concept of ecological threshold[6]. We can think that, when the arbor coverage was less than 12 %, the serious situation of water and soil loss was caused by low coverage of vegetation and lack of surface protection layer. When raining, crown cover has redistribution function on rainfall. Raindrops that are bigger than natural raindrops may form, which will deteriorate water and soil loss. When the arbor coverage was more than 12%, organic matter increased, and the erosion modulus and runoff volume decreased with the increase of arbor coverage. When the arbor coverage was 55%, the organic matter in soil reached peak. When the arbor coverage was more than 55%, the content of these indexes began to decrease with the increase of the arbor coverage, and the erosion modulus and runoff decreased with the increase of the arbor coverage. The result showed that the increase of arbor coverage played a crucial function on the control of erosion modulus and runoff volume. The more arbor coverage is, the less erosion modulus and runoff volume are. However, with the increase of arbor coverage, the growths of woods need to consume too much soil nutrients. But the usable element in soil is limited. When the carrying capacity of woods exceed the land carrying limit, the woods begin to consume soil nutrient excessively, which leads to decrease of organic matter content and recession of soil fertility. Zhao Rudong[7] and Wang Yin[8] drew out the same conclusion in relative research on pinus massoniana forest. They points out that nutrient content of soil in medium-density woods is more than that of too loose and crowded forest stand. Pu Hao[9] also mentioned the problem of woodland construction and proposed suggestion for

development in relative research on forestry management. This paper also put forward the Chinese larch cultivation for protection of water and soil as well forestry[11].

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