EFFECT OF SOIL CHARACTERISTICS IN THE SEED STAND

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Abstract: The project was implemented by the cooperation between the Institute of Geography and Geoecology, Mongolia Center for Forest Biodiversity NGO, and MonConsult Ltd in 2017-2018. The objective of this study was to establish a seed stand in Baruuburen soum, Selenge province. The coordinates of seed stand are 49ө11'09.4"N latitude, 104ө39'06.7"E longitude, altitude is 1107 m a.s.l, and the slope is NE 6 ө. Pure larch forest, dominant trees belong to age class II with an average diameter of 13.0 cm, the average height of 8.4 cm, the distance between trees is 2.5±0.1 m, the crown length is 1.8±0.7 m, height up to the first living branch is 1.3±1.0 m, the number of trees per ha is 324 trees/ha, and density is 0.5. The result of the study showed that all horizons do not have salt formation. Also, the content of mobile potassium and phosphorus is inferior, and humus content is medium. In general, the study suggests all horizons have sandy texture, no pebbles, sparse, and moisture values are low. Soil characterization of the seed stand is suitable for plant growth, but we need to improve soil fertility to increase seed yield.

Keywords: seed stand, soil, soil texture, mechanical components

Introduction

The forests in Mongolia occur mainly in the northern part of the country, which forms a transition between the Siberian taiga forest and the central Asian steppe (World Bank 2002). Closed forests occupy only 8.2 percent of the land area of Mongolia. Most forests in the country are composed of Siberian larch (Larix sibirica Ldb.), covering 59 percent of the closed forest area. Other important tree species include Scots pine (P.sylvestris L.) covering only 5.2 percent, Siberian pine (Pinus sibirica Mayr.), respectively, whereas White birch (Betula platyphylla Sukacz.) accounts for almost 9 percent (MNE, 2015; 2017).

Forest resources in Mongolia have been continuously degraded due to improper exploitation for timberland fuelwood, forest and steppe fires, insect/pests and diseases, mining, uncontrolled grazing, and inadequate forest management.

Reforestation activity in Mongolia started in 1968. A National Forest Policy considered reforestation and tree planting as key objectives, including a collection of seeds, seed storage and processing, development of forest nurseries, and increase of reforestation and afforestation in degraded forests with annual recovery on at least 10000 ha (Batkhuu et all., 2017). Restoration and reforestation activities encounter numerous challenges caused by both biotic and abiotic factors, and success depends on many factors, including seed and seedling quality, site-species compatibility. Improper seed selection is considered one of the key reasons for the challenges faced in reforestation (Bat-Erdene & Dashzeveg 1995). Therefore, seed quality is crucial to promote the quality of planting stocks, to obtain high survival of seedlings, and to increase the growth rate in large-scale rehabilitation and reforestation (Udval, 2014).

Conservation and sustainable management of forest genetic resources is a long-term investment to increase the quality and productivity of

of forest plantations and enriched natural forests. Using the best available seed sources is the first step in silvicultural treatment to increase the productivity of forests. Low qualified seeds not adapted to a specific site result in plantation failures or considerable losses of production. Once a forest is established, it is difficult or impossible to remedy these problems.

Forest seed management covers a set of steps like selection and establishment of seed stands, seed collection, seed transport, seed processing, seed storage, and preparation of seeds for sowing. Most countries have a legal and administrative framework for the conservation and use of forest seed and reproductive materials. Based on this framework, the national forest administrations develop a certification scheme for seeds and seedlings and guidelines for the production of high-value seeds and the whole process from the planning of seed collection via seed handling and processing to seed sowing (Final report, 2018).

Methodology

The methodology developed by N. P. Anuchin (2004) is used for the establishment of sample plots and measurements of tree growth parameters. Genetic selection criteria set by Girgidov (1976) and Lyubavskaya (1982) were applied, and trees were classified into three (3) categories: elite trees or plus trees, normal trees, and inferior trees, respectively.

During a field survey, a partial and complete soil profile was used for the analysis of the determination of morphological characteristics of the soil and collected soil samples for further research in the laboratory. A full profile has a depth of 1.0-1.5 m, and a partial soil profile had 50-80 cm depth. A soil profile is analyzed at the location and is representative of the selected stand. Once the morphological characteristics of the soil are recorded, soil samples (0.3 kg in weight, labeled with the profile number, depth, etc.) were collected from each in the profile. Collected soil samples were subjected to chemical and physical analysis at the Central Soil Laboratory, Institute of Geography and Geoecology, Mongolian Academy of Sciences. The following properties were determined; humus content (%), pH, hydrocarbon (HCO3), absorbed base (Ca2+, Mg2+), soil nutrients such as nitrogen (N), phosphorus (P), potassium (K), salt formation, and exchange sodium (Na), bulk density, texture, etc.

Result and discussion

Inventory and measurements were conducted in 6 ha seed stand in Baruuburen soum, Selenge province, Shar Khooloin am area along with forest user group experts and members.

Picture 1. Seed stands

The coordinates of seed stand are 49°11′09.4″N latitude, 104°39′06.7″E longitude, altitude is 1107 m a.s.l, and the slope is NE 6 °. Pure larch forest, dominant trees belong to age class II with an average diameter of 13.0 cm, the average height of 8.4 cm, the distance between trees is 2.5±0.1 m, the crown length is 1.8±0.7 m, height up to the first living branch is 1.3±1.0 m, a number of trees per ha is 324 trees/ha, and density is 0.5.

Picture 2. The location of the selected seed stand

Table 1. Characteristics of the seed stand (CODE Sel 7)

№	Parameters		Stand information
1	Latin name of tree		*Larix sibirica* Ldb.
2	Mongolian name of tree		Сибирь шинэс
3	Category	Selected	√
		Qualified	
		Tested	
4	Types of forest	Planted	
		Natural	√
5	Location	Longitude	49°11′09.4″
		Latitude	104°39′06.7″
		Altitude	1107 m
6	Origin	Autochthonous	√
		Not autochthonous	
		Unknown	
7	Genetic modification		none
8	Year of seed stand approval		2018
9	Stand type	Permanent	√
		Temporary	
		Elite and plus	
10	Ownership		Selenge province,
11	The organization, which accredited seed stand		
12	Seed region		
13	Province		Selenge
14	Name of soum and location		Baruunburen, Dalt
15	The organization, which approved seed stand		Orkhon FUG
16	Forest resource types (Natural, planted, open woodland)		Natural
17	Types of forest zones (Specially protected area, Greenzone, protection and utilization zone of the river, woodland, oasis, etc.)		Green zone
18	Landscape		Medium slope
19	Area, ha		6 ha
20	Forest vegetation type		Herbaceous subtaiga pine forest
21	Soil type		Carbonated forest dark soil
22	Forest composition		10P+Birch
23	Degree of slope and aspect		NE 6^0
24	Site index		IY
25	Selection assessment		Normal
26	Age/age class		II
27	Density		0.5
28	Average height, cm		8.4
29	Average diameter, m		13
30	Crown shape (symmetric, asymmetric)		Symmetric
31	Trunk shape (conus, straight, cylinder, forked, twisted)		Straight
32	Branching status (fine, coarse, irregular)		Coarse

33	Height up to the lowest living branch on a trunk, m	1.3
34	Number of trees per hectare, tree/ha	824
35	Health classification	1
36	Damage classification	5
37	Funding source	
38	Note	Qualified to be seed stand

Several trees per unit area are normal, and the majority of trees of this seed stand are healthy, with straight stem, thin branches, sufficient natural-pruning, well-shaped symmetric crown, profitable growth in diameter, and height. Furthermore, forestry and pest control measurements need to be taken, and protection from livestock grazing.

Picture 3. Numbered trees in seed stand forestry activity

The area of Shar Khooloin am located in Baruunburen soum, Selenge province Khangai region of Orkhon-Shaamar. The soil region belongs to dark brown forest soil. Forest brown, brown meadow soils are dominated while sparse wood, southern slope, the edge of the forest area was dominated podzol, meadow brown-black soils.

Figure 1. Soil distribution map

Soil properties: Forest dark brown soil: "Ad" 0 – 10 cm depth, dark brown colored, texture is light clay, dry, no pebbles, soil compactness 2.5 kg/cm^2. has abundant plant roots, and has gradual transition by color

"A" 10 – 35 cm depth, dark brown colored, moist, хөнгөн texture is light clay, no pebbles, has average abundant plant roots, dense, soil compactness 3kg/cm^2, and has gradual transition by color and carbonate.

"Bca" 35– 60 cm depth, light brown colored, moist, texture is clay, no pebbles, has few roots, dense, soil compactness 3.5 kg/cm^2.

Chemical properties of soil show that the pH of the horizon between 0-20 cm depths is acidic, 20-325 cm depth is low cutting.

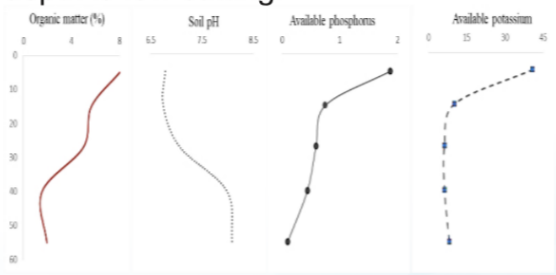

Figure 2. Organic material, reaction medium, and carbonate soil

The horizon between 0-35 cm depths has low carbonate accumulation, and below 35 cm has

some carbonates. All horizons do not have salt formation, and the content of mobile potassium and phosphorus is inferior. Humus content is medium between depth 0-35 cm, and poor below 35 cm depth. The content of mobile phosphorus is low at all horizons.

Table 2. Chemical properties of soil

Profile №	Depthcm	pH H_2O 1:2.5	$CaCO_3$ %	Organic matter %	EC 2.5 dS/m	Available,mg/100g	
						P_2O_5	K_2O
Se18-01	0-10	6.78	0.00	8.013	0.089	1.87	40.79
	10-20	6.74	0.00	5.651	0.040	0.75	10.11
	20-35	7.06	0.00	4.985	0.038	0.59	6.28
	35-45	7.99	16.3	1.546	0.112	0.44	6.28
	45-60	8.09	9.09	1.940	0.138	0.10	8.20

Soil texture is light clay at the horizon between 0-35 cm depth, and below 35 cm depth texture is clay loam. Clay loam is not very suitable for herbaceous plants to grow; however, it is suitable for trees to grow and usually has enough nutrients. All horizons do not have pebbles, dense, and field moisture values are low as 7.5-10.2%.

Table 3. Physical properties of soil

Depth, cm	Amount of soil particles, %			Texture	Total pebbles, %	Bulk density g/cm³
	Sand (2-0.05mm)	Silt (0.05-0.002mm)	Clay (<0.002mm)			
0-10	41.1	44.9	14.0	loam	0.0	0.67
10-20	39.6	45.2	15.2	loam	0.0	1.02
20-35	38.1	47.3	14.6	loam	0.0	1.14
35-45	32.3	51.9	15.8	silty loam	0.0	1.05
45-60	33.8	50.0	16.2	silty loam	0.0	1.09

Soil horizons have sandy texture, no pebbles, sparse, and dust content was low at the upper layer of the soil. The lower layers of soil have a higher surface of dust and clay, and the density of the earth was very high.

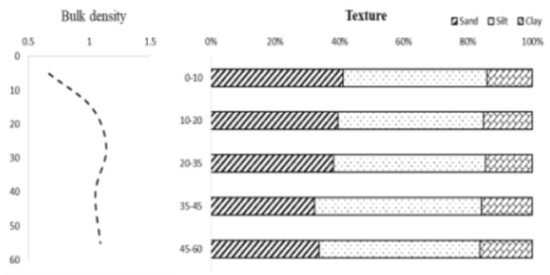

Figure 3. Volumetric distribution and volume of mass and mechanical components

The soil has low acidity and medium alkaline reaction, humus content is high, have to carbonate below 35 cm, and no salt formation. At the depth, 0-35 cm has light loam texture, no pebbles. The reserve of soil humus is 244 t/ha.

Conclusion

The result of the study showed that all horizons do not have salt formation. Also, the content of mobile potassium and phosphorus is inferior, and humus content is medium. In general, the study suggests all horizons have sandy texture, no pebbles, sparse, and moisture values are low. Soil characterization of the seed stand is suitable for plant growth, but we need to improve soil fertility to increase seed yield.

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