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THE APPLICATION OF MYCORRHIZAL PREPARATIONS FOR THE CULTIVATION OF FOREST TREE SPECIESIN SHALDAI NURSERY

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The degree of michurinist of major forest forming species of the Earth is one of the most important indicators of prosperous as 8000 species of higher plants and 7000-10000 species of fungi on the planet form ectomycorrhiza (EcM) involved in the nutrient cycle, optimization of plant metabolism, enhancing mineral nutrition, induction of resistance to drought, salinity, heavy metals, pathogens [1].

There is no more interesting form of relationship between organisms than symbiotic relationships. The most important of the symbioses between plants and fungi is mycorrhiza. It is believed that about 80 % of higher plants have mycorrhizal formations on their roots.

The preservation of environmentally friendly human conditions in various regions of the world depends directly on the rational and careful use of forest resources. The forest ecosystems of Central and North-Eastern Kazakhstan are one of the most important components of the Earth's biosphere that support ecological balance on the entire planet. Ectomycorrhiza plays a leading role in forest biogeocenoses, since it is determined on the roots of dominant tree species [2,3].

Interest in the phenomenon of symbiosis of plant roots with fungi-macromycetes has not faded since Frank described almost all types of ectomycorrhizas in 1885 [4,5].

The term "mycorrhiza" refers to all forms of cohabitation of fungi with the root systems of higher plants. This term was introduced into the special literature by B. Frank [6].

There are more than 5,000 known species of fungi that form ectomycorrhizae, and several different types of ectomycorrhizae have been recorded. The hyphae of most mycorrhizal fungi are distributed in the litter horizon, but some prefer the upper mineral horizons of the soil.

A number of plant, fungi form above-ground fruiting bodies, which are suitable for human consumption. Most species of woody plants growing in the boreal zone form ectomycorrhiza [7].

The goal is to develop a technology for growing coniferous seedlings on substrates of mycorrhizal macromycetes during reforestation of technogenic

disturbed territories of North-Eastern Kazakhstan in order to reproduce the natural symbiosis of coniferous roots with fungi to increase survival, stimulate growth, endurance, and improve the decorative qualities of coniferous and deciduous plants.

Methodology: the material was Collected in the Central and North-Eastern part of Kazakhstan. In the course of the work, we used route and stationary research methods.

On a permanent trial area of 0.11 ha, 2-year-old seedlings of common pine and 2-3-year-old seedlings of hanging birch were planted in the pre-prepared soil in late April and early may 2019. The total amount of planting material is 2160: of these, ordinary pine – 1000 pieces, hanging birch-1160 pieces. Suillusbovinus culture was introduced under pine seedlings, and Boletus edulis culture was introduced under birch using the following technology:

1. for common pine, mycorrhiza was introduced into the root system at the same time as planting. The sample of pine seedlings was 1000 pieces.Planting has 3 repetitions with mycorrhiza-750 PCs, and 1 control - 250 PCs. without mycorrhiza. The rate of application to the soil at the height of seedlings: up to 0.5 meters 50-100 ml. Planting scheme: 1x0. 75 m, with drip irrigation.

2. Mycorrhiza was introduced in the spring in the unfrozen warmed soil. Before planting, the damaged roots were cut off and the root system was renewed or shortened to 20-25 cm. After pruning, the roots were dipped in a chatterbox consisting of a liquid mixture of humus with earth and mycorrhizal mycelium. In order for the planted plants to have the earth firmly attached to their roots, they were trampled. This technique made it possible to avoid voids and bends of the roots. Seedlings were planted 1-2 cm deeper than the root neck .

In the future, the main agrotechnical care was carried out: loosening the soil, destroying weeds, fertilizing plants, watering, protection from diseases and pests.

The second object was a deciduous species, Betula pendula L., hanging birch. In the warm days of may 9-11, 2019, 1160 seedlings of this species were planted: three repetitions with mycorrhiza - 880 pieces, and one control 280 pieces - without mycorrhiza. Landing scheme:1x0,75 m. Type of irrigation-drip irrigation. Ways to infect the root: "chatterbox containing live mycelium of the fungus, with 2-3 – fold immersion of the seedling root (Figures 5,6).

To maintain the identity of the calculations, groups of 250 plants were formed in each group: 1 group-control (without adding a substrate), 3 groups (3 repetitions) – experimental with the introduction of a mycorrhizal substrate.The area of the experimental field is 0.11 ha.

Mycorrhiza was introduced in the spring in the unfrozen warmed soil. Before planting, the damaged roots were cut off and the root system was renewed or shortened to 20-25 cm. After pruning, the roots were dipped in a chatterbox consisting of a liquid mixture of humus with earth and mycorrhizal mycelium. In planted plants, the ground was trampled to fit snugly to the roots. At the same time, without allowing voids and bends of the roots. Seedlings were planted 1-2 cm deeper than the root neck.

In the future, the main agrotechnical care was carried out: loosening the soil, destroying weeds, fertilizing plants, watering, protection from diseases and pests.
Location of the object: State institution state forest nature reserve "Ertisormany" is located in the Eastern part of Pavlodar region on the right Bank of the Irtysh river and is located in the coordinates: North latitude 510 23/ - 52 015/, East longitude 78 001/ - 79 0 21/. The area of the reserve is 277961 ha. It is located on the territory of shcherbaktinsky district (117565 ha) and lebyazhinsky district (160396 ha) [8].

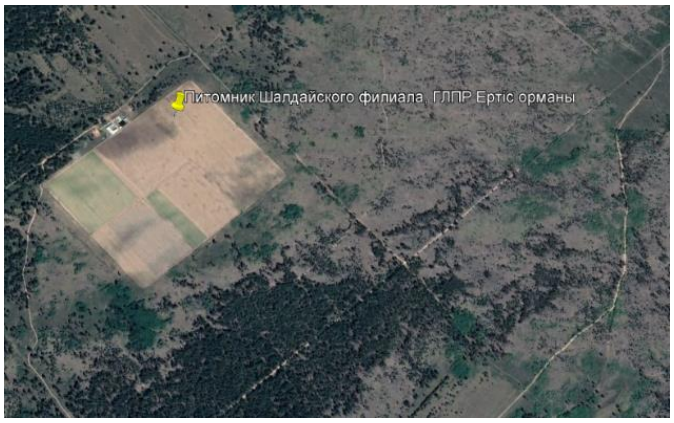

Figure 1.Location of the Shaldai nursery

Monitoring of seasonal dynamics of development of seedlings of Pinussylvestris L. and *Betula pendula* Roth.

Table 1-Biometric indicators of seedlings of Pinussylvestris L. and Betula pendula Roth.by variants of the laid experiments as of 25.06. 2020

Name	Average height,cm	Crown		Average diameter, см	increment
		lengthwise	crosswise		
Pinussylvestris L. with mycorrhiza	26,3±1,0	19,2±0,6	17,4±0,5	1,2±0,5	15,0±1,2
Pinussylvestris L. without mycorrhiza	16,0±1,0	13,0±0,5	12,1±1,0	0,8±0,2	11,0±0,5
The difference between the two samples is determined using a number of criteria: $t \geq 3$	t = 6,4	7,9	4,7	0,8	3,1
Betula pendula Roth.with mycorrhiza	95,0±0,5	-	-	1,4±0,3	-
Betula pendula Roth.without mycorrhiza	71,5±1,0	-	-	1,2±0,6	-
The difference between the two samples is determined using a number of criteria: $t \geq 3$	t = 20,9	-	-	-	-

The data shown in table 4 indicate that mycorrhiza had a positive effect on the growth of both coniferous and deciduous plants. In Pinussylvestris L., the differences in height, crown diameter along and across the row, and the current increase in comparison with the control are significant, more than three, and equal, respectively: 6,4; 7,9; 4,7; 3,1. The diameter of the root neck does not differ significantly - 0.8.

Significant differences in height were observed in the Betula pendula Roth.: t = 20.9.

Table 2-Biometric indicators of seedlings of Pinussylvestris L. and betula pendula Roth. by variants of the laid experiments as of 20.08. 2020

Name	Average height,cm	Crown		Average diameter,cm	Increment
		lengthwise	lengthwise		
Pinussylvestris L. with mycorrhiza	30,4±18	20,2±0,6	18,4±0,2	1,4±0,1	16,7±1,2
Pinussylvestris L. without mycorrhiza	18,0±1,0	15,0±0,5	14,1±1,0	0,9±0,2	14,0±0,5
Betula pendula Roth.with mycorrhiza	126±0,2	-	-	1,7±0,1	-
Betula pendula Roth.without mycorrhiza	83,1±1,0	-	-	1,4±0,4	-

Average height of pine with mycorrhiza 30.4 cm, diameter 1.4 cm, growth 16.7 cm, without mycorrhiza height 18.0 cm, diameter 0.9 cm, growth 14.0 cm. The data shown in table 4 indicate that with mycorrhiza, the biometric indicators of the birch were average height,126 cm, average diameter, cm 1.7, without mycorrhiza average height 83.1 cm, average diameter 1.4 cm.

Table 3. Survival ability of seedlings of common pine and hanging birch by variants of laid experiments as of spring 2020

Studies on the effect of artificial mycorrhiza on the growth of seedlings of common pine and hanging birch in the first year of growth in the conditions of the nursery S "Ertisormany" showed a positive effect on survival, growth in height and diameter.

In the first year of growth, mycorrhiza had a more effective effect on survival on deciduous trees than on coniferous trees. Survival rate in 2019 was 83.3% for hanging birch, 55.2% for common pine, and 81.4% for hanging birch and 53.3% for common pine in 2020.

One of the most important compounds secreted by fungal hyphae is glomalin glycoprotein [11].

Conclusion: Specific characteristics of sapling development parameters depend on the type of plant and age: the average current growth of the theBetula pendula Roth.was higher than that of the Pinussylvestris L.

Studies on the effect of artificial mycorrhiza on the growth of seedlings of common pine and hanging birch in the first year of growth in the conditions of the

nursery SFNR "Ertisormany" showed a positive effect on survival, growth in height and diameter.

In the first year and second year of growth in 2019-2020, mycorrhiza had a more effective effect on survival on deciduous trees than on coniferous trees. The survival rate of hanging birch was 83.3%, and common pine 55.2%.

When conducting research on mycorization of seedlings during planting, a positive effect of mycorrhiza on the growth of both coniferous and deciduous plants was noted. In common pine, the differences in height, crown diameter along and across the row, and the current increase in comparison with the control are significant, more than three, and equal, respectively: 6,4; 7,9; 4,7; 3,1. The diameter of the root neck does not differ significantly - 0.8.

Significant differences in height were observed in the hanging birch: t = 20.9.

The need to study mycorrhizal formation in coniferous seedlings in forest nurseries in Kazakhstan is caused as a way to improve the quality of planting material.

Refences:

1 Rossietal M.S. Effect ofaqueous extracts ofgarlic on the morphology and infectivity ofavenezuelan isolateoftrypanosoma evansi // Acta Microscopica. – 2013. - Vol. 22 (1). -P. 69-78.

2 Smith S.E., Read D.J. Mycorrhizal symbiosis. –London: Academic Press, 2008. – 678 p.

3 Agerer R. Colour Atlas of ectomycorrhizae: With Glossary. - Einhorn-Verlag, Schwabisch, Germany, 1988. - 341 p.

4 Polenov A. B. Mushrooms. Edible and inedible: The most complete and up-to-date determinant Atlas. - Ed. AST "polygon", - 2013. -162 p.

5 Shubin V. I. Macromycetes of forest phytocenoses of the taiga zone and their use. - L.: Nauka, 1990. - 197 p.

6 Frank B. On the nutritional dependence of certain trees on the root symbiosis with belowground fungi (an English transformation of A. B.Frank’s classic paper of 1885) // Mycorrhiza. – 2005. – № 15. – P. 267 – 275.

7 Shubin V. I. Mycotrophy of wood species in the conditions of the North and its significance in reforestation // Scientific notes. Mycorrhiza Perm: Ministry of education of the RSFSR. Perm state pedagogical Institute, 1975, Vol. 150, Pp. 139-147.

8 Roman M., Claveria V., Miguel M. A revision of the descriptions of ectomycorrhizas published since 1961 // Mycology research. The British Mycological Society. UK, 2005. - T.109 (10). - P. 1063 – 1104.

9 Eremin D. I., Popova O. N. Agroecological characteristics of micromycetes living in soil // Bulletin of the Northern TRANS-Ural state UNIVERSITY. - 2016. -№1 (32).– Pp. 12-18.

10 11 Rillig M.C., Steinberg P.D.Glomalin production by an arbuscular mycorrhizal fungus: A mechanism of habitat modification // Soil Biology and Biochemistry. -2002. - no. 34. - P. 1371-1374.