

Siliceous Lignin As Promoter For Root System Development Of Coniferous Trees Seedlings

Galina Telysheva¹, Talis Gaitnieks², Galina Lebedeva¹, Mudrite Daugaviete², Tatiana Dizhbite¹

¹ Latvian State Institute of Wood Chemistry (IWC), 27 Dzerbenes str., Riga, LV-1006, Latvia

² Latvian Forestry Research Institute "Silava"

Contact: Galina Telysheva, ph.: +371 67555916, fax: +371 67550635, e-mail: ligno@edi.lv

ABSTRACT

Siliceous lignin (LSi), synthesized and produced in IWC on the basis of hydrolysis lignin was widely tested as a plant growth and development activator. There are no data regarding LSi influence on the development of ectomycorrhizal fungi which interaction with plant roots leads to the multisided effect close to that observed at LSi application. The aim of the present study was evaluation of the influence of LSi on wood seedlings root system incl. effect on mycorrhizal fungi. The most pronounced effect was obtained for 1 year old pine seedlings growing in glasshouse: root length, volume, number of tips increased by 23%, 37%, 13%, respectively, against control. In 2 years biometric parameters of pine seedlings growing in microfield conditions on the LSi background were better than for spruce and intensity of mycorrhizae development increased by 1,5 times.

KEYWORDS: pine seedlings, roots, mycorrhiza, siliceous lignin

INTRODUCTION

Agrobiological usage of technical lignins forming as wastes from plant chemical processing is the object of investigation during many years. Different modifications are offered for strengthening efficiency of lignin action in system soil – plants. IWC are working out LSi with enhanced auxin-like activity and ability to intensify the activity of soil microbiota. On the LSi background essential speeding up of passing the phenological phases, increasing of the volume and changing of the architecture of roots system, forming of bigger amount of fine roots and increasing of mineral nutrient elements uptake were observed. Comparison of the effects obtained as a result of mycorrhizal fungi interaction with plant root and LSi application on plant development have shown their similarity in many aspects. The possibility of lignin products (Fe-lignosulphonates) to promote interaction was shown recently [Niemek, 2005]. For LSi such a data are unknown. The aim of the present study was evaluation of the influence of LSi on the development of wood seedlings root system including effect on mycorrhizal fungi.

METHODS

Trials were performed in forest nursery ("Strenči") using unmodified hydrolysis lignin (L) and Si-lignin (LSi; 5% Si) which were introduced in furrow before seeds sowing (3 g per 1 running meter) and 40 or 80 mg (glasshouse) under each seed before pine or spruce seeds sowing in containers filled with peat substrate. Root systems of seedlings were measured using calibrated scanner STD-1600+, software WinRhizo 2002C. Results statistic assessment was made using ANOVA. The influence of sterile lignin products (LP, LSi, 2,5% concentration) on the development of ectomycorrhizal fungi colonius (*Paxillus involutus* MSCL 531, *Pleurotus ostreatus* MSCL 489, *Suillus granulatus* MSCL 492, yeast agar medium, Petri dishes) was studied.

RESULTS AND DISCUSSION

The most pronounced effect was obtained for 1 year old pine seedlings growing in glasshouse: on the background of Si-lignin, total root length, volume, number of tips increased by 23%, 37%, 13%, respectively, against control.

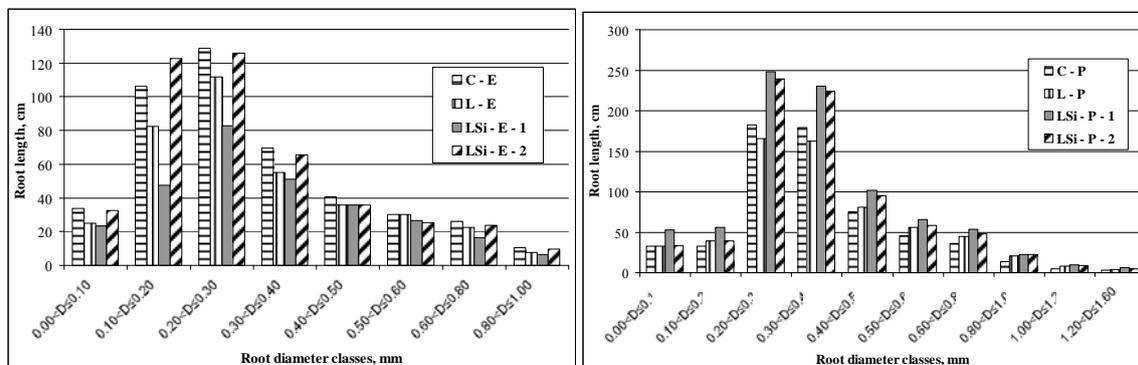


Figure 1. Length of spruce (E) and pine (P) fine roots for 1 year old seedlings grown on peat substrate (C – control), with (L) and different dosages of LSi additives.

In 2 years biometric parameters of pine seedlings (microfield conditions) on the LSi background were better than for spruce: root mass exceeded control by 10%, root system was more branched and able to hold bigger lump of soil and intensity of *Suillus sp. mycorrhizae* development credible increased by 1,5 times. Biometric parameters of pine seedlings.

Table 1. The biometrical parameters of 2 years old pine seedlings.

Variant	Root neck diameter, mm	Overground part mass, g	Roots mass, g	White mycorrhizae, %	Black mycorrhizae, %
Control	2,92	1,77	0,19	44	18
L	3,14	1,97	0,21	48	20
LSi	3,24	2,37	0,21	64	32

The main new results are credible increase in intensity (1,5 – 1,8 times in comparison with control) of mycorrhizal fungi development, especially *Suillus sp.*, for the pine seedlings (Table 1) whereas for spruce only tendency of such an effect is observed. The effects of LSi are time and dose-dependent (Fig. 1 and 2), and promotion of root system development can be realized without assistance of mycorrhizal fungi. In model experiments lignin products suppress development of pure cultures of ectomycorrhizal fungi.

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