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### INFLUENCE OF SELECTIVE THINNING OF PINE SYLVULA ON VULNERABILITY OF FOREST STAND BY ROOT FUNGUS

The article presents the results of susceptibility of pine root sponge on experimental forest plantations and control stands. Found that on plantations with stand density of trees in the 8–11-year age 1000 and 2000 trucks on per 1 ha hearths of root sponges do not appear until 48 years of age. At the same time, at the control stands has shrunken to 650 woody plants per 1 ha.

**Introduction.** In the climate conditions of Belarus root fungus (*Fomitopsis annosa* (Fr.) Karst.) causes a considerable damage to common pine sylvula. Its negative impact takes place the most on former agricultural lands where as a result of this disease productivity of forming phytocenosis crops decreases.

In this respect research results of influence of selective thinning of pine sylvula on vulnerability of forest stand by root fungus is of a considerable interest. This work was carried out at permanent study areas on planted forestry that were formed due to the process of thinning of pine sylvula at the middle of the first class age.

Pine sylvula was planted on old soils in SEFBA “Glubokoe Experimental Forest Enterprise” and in SFBA “Dvinskaya EFF” of Belarus NAS at Institute of forest.

**Main part.** Thinning of 8–11-year-old pine sylvula was carried out in summer 1976 and in spring 1977. Thus, every second row of woody plants at experimental forest plantations was completely cut out and selective thinning was carried out in other rows. At thinned and test plots, options with mineral fertilizers and perennial lupine were provided.

In 1984 the personnel of the forest protection chair of the BSTU under the leadership of professor N.I. Fedorov at the permanent study areas #1 and #2 revealed 4 and at the permanent study area #3 – 2 appearing focuses of root fungus. In 1986 at permanent study areas #1 and #2 infected trees were cut out. At the permanent study area #3 with density of 4 thousand trees per 1 ha the focus of infection was isolated not only by thinning of dry, drying, weakened and healthy trees growing near them but also by simultaneous processing of stubs with oidium peniophora gigantic suspension. Besides, in a circumferential direction of the focus of the infection by 0.5 l of fundazol suspension was used into the circles around the tree trunks.

Studies on the influence of selective thinning of pine sylvula growing on old soils on vulnerability of forest stand by root fungus started in summer 1994. Thus, at the permanent study areas #1,2 and 3 the detailed phytopathological examination of

forest stand was carried out. It was revealed that at experimental forest plantations vulnerability of the pine by root fungus sharply decreases.

Forest stand with density of 3.6-4.0 thousand trees per 1 ha as well as control phytocenosis crops (7-8 thousand) are the most vulnerable to the infection, where, as it was revealed, in focuses of infection 75-85 trees per 1 ha dry out by 25-27 years. At density of 1.8-2.0 thousand trees, where in contrast to these variants of density, during the process of thinning all dwarfed trees were cut out.

A number of affected with root fungus trees made 70% less and only in one case such affection was revealed at the plantations with the density of 1 thousand trees per 1 ha. Additional phytopathological research at permanent study areas was carried out in summer 1996. Thus, vulnerability of pine was established not only judging by variants of experience but also by nearby standing same-aged forest stand in which vulnerability of trees by root fungus considerably increased (table).

So, at the experimental forest plantations with density of 1 and 2 thousand trees per 1 ha at the permanent study area #1 infection focuses appeared only in two of the 8 examined sections and in the two cases on the working plots where fertilizers and herbicides were used.

At the working plots with perennial lupine this infection was not revealed while in the check forest stand 160-162 trees per 1 ha dried out of it.

As a result of undertaken measures at experimental forest plantations (permanent study area #3) damage from the infection was considerably reduced but in the check sylvula with density of 4 thousand trees per 1 ha neither cutting out of near standing healthy trees nor special processing of the stubs helped.

As it is seen from the table, forest stand where localization of drying focus was carried out, it was considerably affected by the root rot. And this is in spite of the fact that a pine singles out for its high sustainability and external symptoms of affection by this infection may be observed only in case of root damage not less than 40% and as it was noted by D.A. Bogdanova drying of a tree [1] starts only at 90-100% of destruction of roots.

**Number of dried out trees per 1 ha as a result of root fungus infection  
at pine plantations with the usage of chemical and biological melioration**

Test variations	Density at the age of 8–11, thousand trees per 1 ha			
	7–8 (control)	4	2	1
<b>Area No. 1<sup>1</sup> (June 1996)</b>				
Without fertilizers and herbicides	213	0	0	0
Fertilizers	43	0	0	0
Herbicides	–	159	54	0
Fertilizers and herbicides	–	114	0	13
<b>Area No. 2<sup>2</sup> (June 1996)</b>				
Without lupine	162	–	0	0
Lupine	160	0	0	0
<b>Area No. 3<sup>3</sup> (June 1996)</b>				
Without fertilizers	382	–	–	–
Fertilizers	567	190	0	0
<b>Area No. 3<sup>3</sup> (April 2013)</b>				
Without fertilizers	453	–	–	–
Fertilizers	656	223	0	0

*Notes:*

1. Sylvula of common pine at the permanent study area #1 was planted in spring 1969; it was thinned in May and June 1976.
2. Planting of pine and perennial at the permanent study area #2 was carried out in spring 1966, thinning was carried out in summer 1976.
3. Sylvula of common pine at the permanent study area #3 was planted in spring 1966; thinning was carried out in April 1977.

It should be underlined that phytopathogen situation at the permanent study area #3 has not changed in summer 2003 too.

It was proved by the results of the third examination of experimental forest plantations and check forest stand [2] carried out by professor N. I. Fedorov and his colleagues.

Reaction on the examining infection of 700 trees-leaders per 1 ha is of a certain interest. The results of the research show that drying of large trees at experimental forest plantations with density of 1-2 thousand in comparison with a control decreases 6–19 times. It is notable that in a control together with dieback of stunted trees dwarfness of trees-leaders is observed [2].

During the latest study of experienced forest plantations of common pine and check trees that was carried out in April 2013 at the permanent study area #3 it was revealed that at the density of 1-2 thousand trees per 1 ha focuses of root fungus were absent in trees at the age of 48. At the same time at the check working plots fading of infection focuses was observed too which is connected with age increment of the examining forest stand [3]. Absence of drying out and drying trees at their boundary with healthy forest stand testifies about fading of infection focuses.

Without any doubt, decrease of pine affection by root fungus at forest plantations caused by considerable transformation of phytocenosis after intensive selective thinning of young trees in the

middle of the first class age is observed. As a result of this intraspecific competition of woody plants in pure by its composition forest stand considerably weakens.

Besides, a great number of secondary insects appear in dense stand that contribute to the intensive spreading of root fungus [4]. Progress of infection in check plants is likely connected with a great number of weakened by competition for the feeding area wood plants. It is notable that in experimental plants of the Institute of forest, in planning quarter 32 of Barbarovsk forestry of Narovlya leskhoz, established by Baginskiy the employee of the BelSRIF V.F., by the age of 28 pine has preserved well only at experimental working plots at density of 0,5–3,0 thousand trees per 1 ha, but at bigger density it was almost completely destroyed by root fungus.

**Conclusion.** One of the essential factors for decrease of fungus affection at experimental forest plantations is alteration of light regime under the shelter of forest stand [3]. In spite of the fact that authenticity of negative correlation between the number of faded out trees and the light under the shelter of the forest stand is not confirmed, however, the tendency of such a correlation exists [2]. As it was revealed by our research alteration of light after the process of thinning of forest plants as old as in the middle of the first class age provides intensive growing of herbous and suffruticous plants. Decrease of the number of faded

out trees at experimental forest plantations at the increase of forest live cover makes considerable alterations to the process of forming of forest floor in which necessary conditions for the development of root fungus are created [4]. Alterations of the forest floor and considerable decrease of its mass reduce damage of the most dangerous infection of forest.

It should be also mentioned that in case of using of mineral fertilizers, not only the increase of growth of pine is observed but there is also intraspecific competition that can cause increase of fading out of dwarfed trees. Under these conditions damage from root fungus is slightly increased. At the same time, introduction of perennial lupine into pine sylvula increases resistance of this species to root fungus and as it was noted by A. I. Gonchar [5], at long-term growth of lupine its alkaloids suppress activity of a great number of microbes and fungus including the above mentioned infection. At forest plantations where perennial lupine accumulates considerably bigger phytomass, its suppressing action into root fungus can only be increased, as professor B.D. Zhilkin noticed in the seventies [6].

Thinning of young trees as old as in the middle of the first class age provides decrease of the number of roots in soil prevents spreading of the infection the most. And stubs from the dwarfed 8-10

years-old trees left after the thinning in contrast to stubs from dying trees still preserve the ability to intensive gum exudation and consequently protection from the infection spreading. It cannot be excluded that some trees at experimental forest plantations are contaminated with root rot to some extent, however, under the conditions of weakened intraspecific competition external symptoms of the infection do not appear.

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