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SOME PROPERTIES OF SOILS AND INCREASING THEIR FERTILITY IN SEED BRANCH OF SCOTS PINE IN THE OPEN GROUND FOREST NURSERIES

Evaluation of soil fertility in forest nurseries in the seed compartment of Scots pine in the open ground. Describes the soil of nurseries by origin of parent rocks and morphological features. For seedling nurseries surveyed, soils are characterized by favorable water-physical properties, structure, porosity. All of the examined soils in the lower soil horizons, are characterized by a light granulometric composition, which helps to remove excess moisture for growing seedlings. Determined humus content and acidity, as well as the content of the main macroelements in the plough horizon. The amount of acidity pH ranges from 5.23 to 6.19. In the surveyed nurseries are regularly made lime fertilizers, and soil in these cases are characterized as slightly acidic and close to neutral, respectively, application of lime fertilizers on these nurseries is not required. We studied the soils of forest nurseries main nutrients, and proposed ways to improve soil fertility. As indicators of soils forest nursery mobile phosphorus, exchange potassium is characterized by uniform distribution throughout the seed branch of Scots pine. In the assessment of nutrients in forest nurseries surveyed used a scale of soils, V. S. Pobedova. Based on the obtained data about the soils of forest nurseries batteries, when grown on them, the Scots pine were proposed types and doses of complex fertilizers of prolonged action to improve the fertility of the soil.

Key words: seedlings, Pinus sylvestris, branch of the seed, the soil, the arable horizon of the soil fertility, humus, soil acidity, fertilizer complex.

Introduction. The main means of fertility increase and soils improvement in nurseries is fertilizers application and liming in combination with regulation procedures of water-air mode. Correct fertilizers application provides the necessary level of seedlings nutrition and, therefore, cultivation of a high-quality planting stock.

Selection of this or that kind of fertilizers and of the dose depend on agrochemical properties and granulometric compositionof soils, of species being grown, etc. General principles of fertilizers application technology in forest nurseries were developed and taken as the basis at compilation of zonal recommendations [1].

In forest nurseries at cultivation of planting stock a considerable elements quantity from the top arable horizon is annually carried out, it happens because of the following factors: absorption by seedlings root systems at their growth, their decomposition in soil by microorganisms, partial washing away in the lower horizons, carrying out by weeds, carrying out of topsoil at seedlings digging out.

At seedlings cultivation the soils acidity increases thanks to organic acids inflow at allocation of plants roots, due to application of fertilizers, acidifying the soil and etc. At high pH value plants badly appropriate nutrients, and that further leads to reduction of growth indexes of planting stockin forest nurseries [2].

As a result of studying of soil conditions of sowing branch of Scotch pine in the open ground of forest nurseries, and also of soil fertility determination in them a detailed inspection of three forest nurseries, namely in SFI “Smolevichy forestry”, in SFI “Logoisk forestry” and in Negoreloe experimental forestry was effected.

Main part. For soils determination mixed samples were taken from the top arable horizons (to receivereliable results not less than 7 mixed sampleswere chosenfrom each nursery, each one was chosen using the envelope method) in the sowing branches of Scotch pine [2].

While describing genetic horizons which were singled out in the soil cut, the granulometric composition of each of them was examined.

Soils granulometric composition was determined using methods of A. N. Sabanin (for sabulous soils) and of N. A. Kachinsky (for loam soils). Humus content in soil samples was determined according to method of I. V. Tiurin in modification of V. N. Simakov; pH value – in salt extract KCl using a pH-meter; hydrolytic acidity – according to Kappen method; exchange bases content of calcium and magnesium – using the trilonometry method; mobile forms of phosphorus – according to method of A. T. Kirsanov on PhEC; metabolic potassium – using method of A. D. Maslov on a flame photometer [3].

Soils provision degree with mobile nutrients and the necessary doses of their application were determined according to classification of V. S. Pobedov [1].

Soils granulometric composition makes an essential impact on soil fertility and fertilizers efficiency, and also on plants providing with water and nutrients. Determination of soils granulometric composition in arable horizon of forest nurseries is given in Table 1.

Table 1

Granulometric composition of arable horizon

Forestry	Fraction content with diameter of, mm								Soil type according to granulometric composition
	7–5	5–3	3–1	1.0–0.5	0.50–0.25	0.25–0.05	0.05–0.01	Physical clay	
Negoreloe experimental forestry	–	–	0.55	5.16	42.68	33.65	6.15	11.81	Loose sandy loam
SFI "Logoisk forestry"	–	–	0.32	3.74	10.54	19.80	42.45	23.15	Light loamy soil
SFI "Smolevichy forestry"	0.13	0.78	4.64	11.55	13.05	40.65	11.45	17.75	Cohesive sandy loam

Analyzing the results, it is possible to notice that the nurseries soils are rather different according to the origin of soil-forming species and to morphological characters. So, in SFI "Smolevichy forestry" the arable horizon is presented by cohesive mora in esandy loam, in SFI "Logoisk forestry" – by light loess-like loamy soil, and in Negoreloe experimental forestry – by loose water-glacial sandy loam.

Lower on profile all soils are characterized by easier granulometrics composition which provides diversion of surplus moisture at seedlings cultivation. According to humus content the forest nurseries soils in the sowing branch of Scotch pine are characterized by low and average provision degree and belong to groups II and III: for SFI "Smolevichy forestry" the value is 2.67%, and that corresponds to provision group III, for SFI "Logoisk forestry" – 1.90% and for Negoreloe experimentation forestry – 1.85%, and that corresponds to group II. Soils the nutrients content in which does not provide enough plants nutrition belong to the low group (group II). Seedlings are responsive to fertilizers application on such soils. Soils with average provision (group III) are the soils with optimum nutrients content for seedlings growth. Fertilizers are introduced in the doses compensating the annual carrying out on such soils.

In addition to mineral fertilizers application, it is necessary to introduce organic fertilizers in the form of composton these soils.

Soils acidity value pH in the sowing branch of Scotch pine varies from 5.23 to 6.19, as in these nurseries limy fertilizers are regularly introduced, and soils in these cases are characterized as subacid and close to neutral accordingly, hence, introduction of limy fertilizers in the given nurseries is not required. In SFI "Smolevichy forestry" the optimum acidity for Scotch pines seedlings cultivation (pH 4.5–5.6) is noted.

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In Negoreloe experimental forestry and in SFI "Logoisk forestry" pH is above the optimum value for Scotch pine, therefore it is recommended to introduce sulphur, acetic acidsolution, fertilizers acidifying the soil solution, nitric (except urea), potassium and complex fertilizers (composed of nitrates and potassium fertilizers) which will optimize the soils acidity.

At Scotch pine seedlings cultivation in SFI "Logoisk forestry" the sum of calcium and magnesium is 6.70 mg-eq. on 100 g of soil, soils saturation degree with bases is 76.2%; in SFI "Smolevichy forestry" it is 5.62 mg-eq. on 100 g of soil and 63.6% accordingly; in Negoreloe experimental forestry it is 6.90 mg-eq. on 100 g of soil and 66.5% accordingly.

Determination results of provision degree by plants basic nutrients in soils of forest nurseries at Scotch pine cultivation are given in Table 2. Soils provision by mobile forms of phosphorus in the

sowing branch of Scotch pine in the open ground is characterized by the low level in the nursery of SFI "Smolevichy forestry", and in SFI "Logoisk forestry" and in Negoreloe experimental forestry – by the increased level. The experiment accuracy figure at provision degree determination by mobile forms of phosphorus in all nurseries does not exceed 2%, hence it is possible to draw a conclusion that the received results are reliable and accurate. The standard error at provision degree calculation by mobile forms of phosphorus from the average value in SFI "Logoisk forestry" makes ±0.35, in SFI "Smolevichy forestry" – ±0.08, and in Negoreloe experimental forestry – ±0.32. All sowing branch is characterized by uniform distribution according to the content of mobile phosphorus, and it means that it is necessary to introduce fertilizer in regular intervals on all territory [4, 5].

According to soils provision degree by metabolic potassium (Table 2) the following results were received: sowing branch of Scotch pine in nurseries of SFI "Smolevichy forestry" and Negoreloe experimental forestry belongs to average provision degree of security, SFI "Logoisk forestry" – raised. The experiment accuracy figure at soils provision degree determination by metabolic potassium in all nurseries does not exceed 2%, hence it is possible to conclude that the received results are reliable and accurate. The standard error at provision degree calculation by metabolic potassium from the average value in SFI "Logoisk forestry" makes ±0.43, in SFI "Smolevichy forestry" – ±0.29, and in Negoreloe experimental forestry – ±0,51.

Just as according to soils provision indexes of the forest nursery by the mobile phosphorus, metabolic potassium is characterized by uniform distribution on all territory of Scotch pine sowing branch.

Available potassium content varies mostly from 5 to 25 mg on 100 g of soilin the soil. Potassium content in soil depends on its granulometric composition [6].

Content of mobile forms of iron in all inspected nurseries is almost identical: for SFI "Logoisk forestry" the value is 3.72 mg on 100 g of soil; for SFI "Smolevichy forestry"– 3.92 mg on 100 g of soil and for Negoreloe experimental forestry – 3.93 mg on 100 g of soil. The standard error at calculations in all nurseries is equal to ±0.10, and that speaks about the received resultshigh accuracy. All sowing branch is characterized by uniform distribution according to the mobile iron content.

Correct fertilizers application provides the necessary level of seedlings nutrition and, consequently, cultivation of high-quality planting stock [7].

Information about the introduction norms of mineral fertilizers in forest nurseries is given in Table 3.

Introduction norms of mineral fertilizers are established not only on the basis of provision by nutrients forms ready for assimilation, but also with the account of the soils granulometric composition. The suggested agrotechnics of fertilizers application provides also for their introduction in the form of [8].

Mineral additional fertilizing is recommended for seedlings nutrition improvement. In the sowing branch of the first year of cultivation of Scotch pine in the open ground in the first half of vegetation period the root additional fertilizing by nitric fertilizers is required 2–3 times.

It is necessary to begin additional fertilizing after mass shoots or with the beginning of active plants growth and to conduct with the interval of 15–20 days. The fertilizers quantity for root additional fertilizing is established depending on the soils provision degree by nutrients and application intensity of the main fertilizers.

Table 2

Provision by mobile forms of phosphorus and potassium of forest nurseries soils at Scotch pine seedlings cultivation on them, mg on 100 g of soil

Forestry	P_2O_5	Provision degree by P_2O_5	K_2O	Provision degree by K_2O
Negoreloe experimental forestry	13.23	IV	6.52	III
SFI "Logoisk forestry"	13.56	IV	20.37	IV
SFI "Smolevichy forestry"	4.22	II	9.28	III

Table 3

Introduction norms of mineral fertilizers at Scotch pine cultivation in the open ground of forest nurseries, kg d. v./hectare

Forestry	Provision degree	P_2O_5	K_2O
Negoreloe experimental forestry	Increased/average	20	35
SFI "Logoisk forestry"	Increased/increased	20	20
SFI "Smolevichy forestry"	Low/average	110	35

It is possible to use such complex fertilizers, as kristalon, analogue of kristalon (Grodno), amofos as root additional fertilizing, etc.

Conclusion. According to the research results of cultivation conditions of Scotch pine seedlings the complex measures on soil fertility restoration are carried out to increase the cultivation efficiency of the planting stock. One of such measures is fertilizers introduction.

In SFI "Smolevichy forestry" it is necessary to introduce the main nutrients on reactant: phosphorus – 110 kg/hectare, potassium – 35 kg/hectare. In SFI "Logoisk forestry" it is necessary to introduce phosphorus – 20 kg/hectare, potassium – 20 kg/hectare. In Negoreloe experimental forestry it is necessary to introduce phosphorus – 20 kg/hectare, potassium – 20 kg/hectare. It is proposed to use complex mineralfertilizers as fertilizers, which permit to introduce into soil at same time instant all necessary major mineral elements in the dosage necessary for sufficient nutrition of Scotch pine seedlings.

Thus, complex mineral fertilizers can be applied not only as the main fertilizers, but they also can be uses as additional fertilizing.

It is offered to introduce PG-mix at sowing, and also according to the inspection results of the nurserysoils. It is also recommended to use the following complex fertilizers: analogue of PG-mix, the granulated fertilizer "Florovit", the fertilizer of durable action "Force of growth", the fertilizer complex "Vitococktail", etc.

Application of the given fertilizers will permit to increase quality, and also yield of standard planting stock of Scotch pine in the sowing branch.

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