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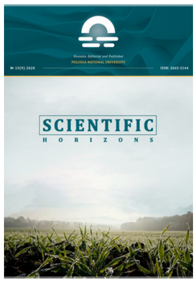

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The Effect of Neutralising Materials on the Reaction of the Peat Substrate Medium when Growing Ball-Rooted Seedlings

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Abstract. The use of various types of neutralising materials in the cultivation of standard planting material of high-quality forest wood species has a significant effect on substrate acidity. Therefore, the study sets a goal to select peat substrates with different dosages of the neutralising component and determine their effect on the reaction of the peat substrate medium. The paper presents the results of the influence of neutralising materials of dolomitic meal and chalk of various doses with the use of mineral fertilisers. Dolomitic meal was used as a neutralising component, the pH of the peat substrate was 6.6 and chalk was 7.5. It was found that when neutralising a peat substrate created based on high-moor milled peat (pH 2.5) with the introduction of dolomitic meal in doses of 2-4 kg/m^3 (European spruce), 3-4. 5 kg/m^3 (Scots pine), optimal acidity can be achieved in a month. An increase in the concentration of lime material was recorded, which leads to an increase in the neutralisation of the substrate at a dose of 2.5 g and 3.0 g per 125 g of peat. The best indicators were demonstrated by options of doses of 1.5-2.5 g per 125 g of peat for 7-8 days of use and a dose of 3.0 g per 125 g of peat for 5-6 days compared with the control. An increase in the concentration of chalk in the neutralising material from 30% to 70% leads to a faster deoxidation of the substrate (pH 3.2), and an increase in the dosage of chalk increases substrate neutralisation. The electrical conductivity of the substrate at a dosage of 6-8 kg/m^3 when applying chalk and dolomitic meal increases by 1.6-2.0 and 1.2-1.4 times, respectively. At the rate of application of 6-10 kg/m^3, it has a lesser effect on the change in the electrical conductivity of the high-moor peat, and the introduction of dolomitic meal 2-4.5 kg/m^3 into the milled peat during neutralisation does not lead to a change in the electrical conductivity of the peat. This data allows choosing neutralising materials of a certain concentration that will enable the cultivation of standard planting material of European quality and thereby ensure the proper quality of future stands

Keywords: acidity of the medium, planting material, dolomitic meal, chalk, peat, substrate

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INTRODUCTION

In the 21st century in the Republic of Belarus, high-moor peat, enriched with the necessary nutrients and pre-neutralised, is used in containers for preparing the substrate for the cultivation of standard seedlings [1-3]. The success of growing planting material is influenced by technical and technological aspects. Technical problems are associated with the use of lines for filling cassettes and sowing seeds, and with technical means of observing the elements of growing technology. These problems can be solved at the level of the equipment manufacturer, provided that the entire line of equipment is assembled by one manufacturer, or there is a risk of the inconsistency of individual components, which can be expressed in a decrease in the quality of filling cassettes or sowing seeds, violation of growing regimes. Technological problems can be caused by regional features that affect individual elements of the technology, for example, the choice of substrate, the microclimate of the substrate, mineral nutrition, water regime, etc. [4-7].

When using peat as a substrate for growing seedlings, it is necessary to take into account the influence of the entire organic complex of peat mass as a carrier of a wide variety of physiologically active substances, which manifests itself mainly in stimulating the growth processes of vegetative organs, intensifying protein metabolism and in the relative inhibition of the synthesis of a complex of carbohydrate substances [8; 9].

There is no unambiguous opinion on the preparation of peat substrates for the cultivation of ball-rooted planting stock (BRPS) among the producers of planting material. Each breed has its own optimal characteristics, which requires mandatory preliminary testing before preparing the substrate. As a result of conducting detailed studies on the chemical properties of the substrate suitable for growing BRPS, it is necessary to establish its best indicators [10]. The formulation of the substrate varies not only between manufacturers, but also in the case of self-preparation of a nutrient substrate – within each centre for growing BRPS [10]. Sometimes certain target additives are added to the substrate, which allow changing the chemical or water-physical properties of peat. The main goal, in this case, is the enrichment of the substrate with nutrients to ensure an optimal nutrition regime for young plants immediately after transplanting to the forest-cultivated area. Another possible option is to ensure a favourable water regime of the substrate by creating moisture reserves in it, which allows for rational use of it on the forest-cultivated area when there is a shortage of atmospheric or soil moisture [6]. Therefore, the cultivation of BRPS of the main forest-forming species with an optimal reaction of the environment would allow obtaining a high yield of standard seedlings for creating forest crops on the territory of the Republic of Belarus.

Since there are quite large areas of swamps on the territory of Belarus – about 2.5 million hectares (14.1% of the total area), the reserves of raw peat are about 30.4 billion m^3 [8], which is used in greenhouses when growing seedlings of forest tree species in the closed ground. The peat of high moors contains an insignificant amount of macronutrients (about 0.56-2.0% nitrogen, 0.03-0.26% phosphorus and 0.01-0.1% potassium), but such a substrate has a high water-retaining and absorbing capacity (moisture capacity 600-1200% by volume, 56-84% by weight), and valuable bactericidal properties that block the spread of fungal microflora. The acidity of the high-moor peat (pH 3.2) is negative, which prevents the development of good seedlings. Therefore, the study selected the most common neutralising materials and their doses in a certain ratio relative to the control to grow a standard planting material with improved planting properties.

The purpose of this study is to determine the effect of neutralising materials on the reaction of the peat substrate medium for their use in growing ball-rooted seedlings.

The object of study is a substrate for growing ball-rooted planting stock. *The subject of study* is the selection of peat substrates with different dosages of the neutralising component.

MATERIALS AND METHODS

Dolomitic meal with a mass fraction of magnesium and calcium carbonate and chalk with a mass fraction of calcium carbonate of at least 85% were used as a lime material. Experimental studies were conducted in March-April 2020-2021 in laboratory conditions at a temperature of 17-20^{0}C and relative humidity of 50-60%. For the integrity of the experiment, 2-litre containers of polyethylene were used. The active experiment was based on two coniferous wood species (pine and spruce) in 2 or 5-fold repetition for each study option with a certain ratio of doses of dolomitic meal and chalk, which is designed for 500 cm^3 (125 g) of separated high-moor milled peat (fraction 0-7 mm).

To optimise the acidity, mixtures of dolomitic meal and chalk were used in different ratios and different dosages in 3 repetitions:

Option 1: with an excess of dolomitic meal in the composition, the ratio was in the total weight of dolomitic meal (70%) and chalk (30%), respectively, and the dosage of mixed lime substance in the experimental options was: 1.5 g; 2.0 g; 2.5 g; and 3.0 g of mixed lime substance per 125 g of peat;

Option 2: in the composition, the ratio was in the total weight of dolomitic meal (50%) and chalk (50%), respectively, and the dosage of mixed lime substance in the experimental options was: 1.5 g; 2.0 g; 2.5 g; and 3.0 g of mixed lime substance per 125 g of peat;

Option 3: with an excess of chalk in the composition, the ratio was in the total weight of dolomitic meal (30%) and chalk (70%), respectively, and the dosage of the mixed lime substance in the experimental variants was: 1.5 g; 2.0 g; 2.5 g; and 3.0 g of mixed lime substance per 125 g of peat.

The pH value of the deoxidised peat was analysed for 8 days in accordance with GOST 11623-89 [11] until the onset of constant acidity. A characteristic feature of peat is the high water content in it. The ratio of the weight of moisture in peat to the weight of wet peat or to the weight of its dry matter, expressed as a percentage, is called peat moisture. The moisture content of peat was determined in accordance with GOST 11305-2013 [12].

The moisture content in peat as a percentage of the weight of wet or dry peat substrate is calculated according to the equations (1-2):

$$W_{rel} = \frac{m_b - m_c}{m_c - m_p} \cdot 100$$

$$W_{abs} = \frac{m_b - m_c}{m_c - m_p} \cdot 100$$

The humidity result is recalculated according to the equations (3-4):

$$W_{rel} = \frac{100 \cdot W_{abs}}{100 + W_{abs}}$$

$$W_{abs} = \frac{100 \cdot W_{rel}}{100 - W_{rel}}$$

where W_{rel}, W_{abs} – relative and absolute humidity of the substrate, %; m_b – the weight of aluminium weighing cups with the substrate before drying, g; m_c – the weight of aluminium weighing cups with the substrate after drying, g; m_p – the weight of aluminium weighing cups, g.

The total acidity of peat includes active (pH) and potential acidity, the latter is divided into the exchange and hydrolytic. Since peat has a large moisture capacity and its acidity is mainly conditioned by the presence of a large amount of free humic acids in it, it is necessary to take a wider (1:25) ratio of peat to the solution when determining the acidity (1:2.5) compared to mineral soils (1: 2.5).

The particle size distribution was determined using a Fritsch GmbH laser microanalyser Analyte 22. The X-ray phase analysis was performed using a Bruker X-ray diffractometer "D8 Advance", which includes an X-ray tube with a copper cathode. Table 5 shows the technical characteristics of dolomitic meal GOST 14050-93 (data from the manufacturer of JSC "Dolomit") [13].

RESULTS AND DISCUSSION

The negative property of high-moor peat – excessively high acidity. According to L.P. Smoliak [14], the acidity of peat in the high moors of Belarus is at the pH_{KCl} level of 3.2-4.2, and according to V.A. Ipatiev – pH_{H2O} 2.6-4.2 [7]. The studies of N.I. Piavchenko [15] established that the acidity of the high-moor peat of the northern regions of Europe is pH_{KCl} 2.8-3.7 [15].

To determine the acidity in this experiment, milled and spade-cut peat of PU "Vitsebsktorf" (Vitebsk region, Dokshitsky district) was used. Peat samples were selected from big bales in the Republican Forest Selection and Seed Centre, followed by mixing and forming an average sample (Table 1).

***Table 1**. Options of peat samples and its acidity for analysis*

Sample option	Sample characteristics	pH in KCl	Repetition of the determination
1	Milled peat	2.63	5
2	Spade-cut peat	2.58	5

Under laboratory conditions, peat samples were dried to an air-dry mass, then their analysis was carried out according to modern methods used in the study of peat and substrate [15]. The pH value of peat was determined using a pH meter in a KCl salt extract [11], which is similar in its values in peat of various types of preparation. This acidity is characteristic of peat bogs. When using lime material with an excess of dolomitic meal in the composition and ratio of the dolomitic meal (70%) and chalk (30%), the following results were obtained (Fig. 1).

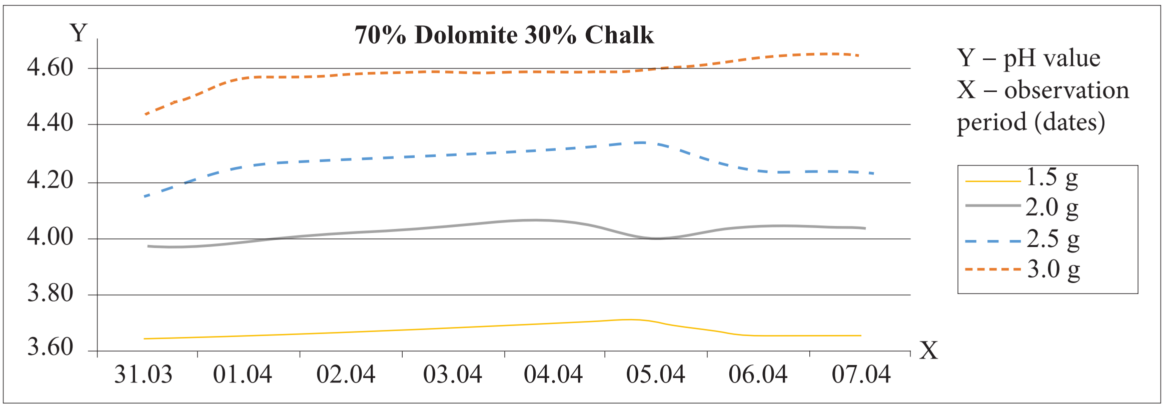

***Figure 1**. Change in the pH value with the predominance of dolomitic meal in the mixture (70%) over chalk (30%) as a neutralising component*

Increasing the dosage of the mixed lime material increases substrate neutralisation. However, the growth of deoxidation process does not occur quite evenly. At a dosage of 1.5 g of lime material, the final pH value was 3.66, and at dosages of 2.0 and 2.5 g – 4.04 and 4.22, respectively. At a dosage of 3.0 g, the pH value was significantly higher and amounted to 4.64.

The use of an equal ratio of dolomitic meal and chalk in the composition (50% each) indicates that an increase in the dosage of the mixed lime material increases the neutralisation of the substrate, while the growth of the deoxidation process occurs more evenly (Fig. 2).

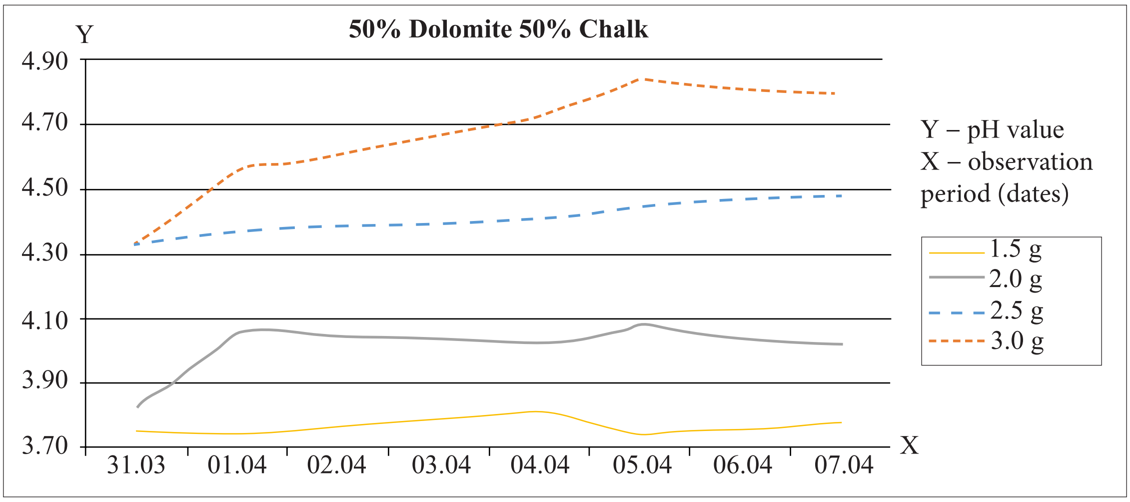

***Figure 2**. Change in the pH value at an equal ratio in a mixture of dolomitic meal (50%) and chalk (50%) as a neutralising component*

At a dosage of 1.5 g of lime material, the final pH value was 3.77; 2.0 g – 4.03; 2.5 g – 4.48; 3.0 g – 4.80, respectively.

The use of lime material with an excess of chalk in the composition with a ratio of dolomitic meal of 30% and chalk of 70% indicates that an increase in its dosage increases the neutralisation of the substrate (Fig. 3), while the growth of the deoxidation process also occurs more evenly. At a dosage of 1.5 g of lime material, the final pH value was 3.70, at a dosage of 2.0 g – 4.03, at a dosage of 2.5 g – 4.34, at a dosage of 3.0 g – 4.81.

The process of neutralising the substrate using different dosages of mixed lime material is shown in Figure 4.

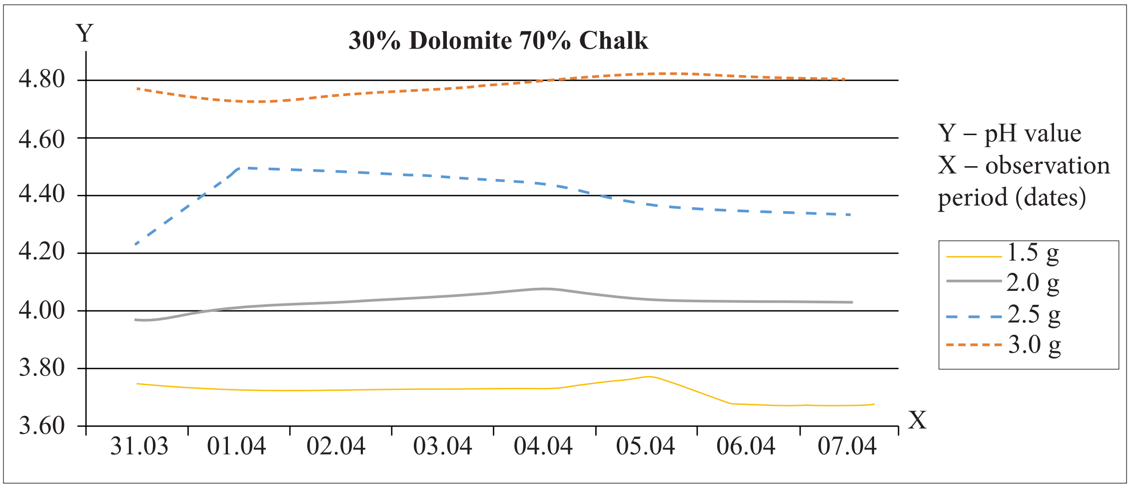

***Figure 3**. Change in the pH value when chalk (70%) prevails in the mixture over dolomitic meal (30%) as a neutralising component*

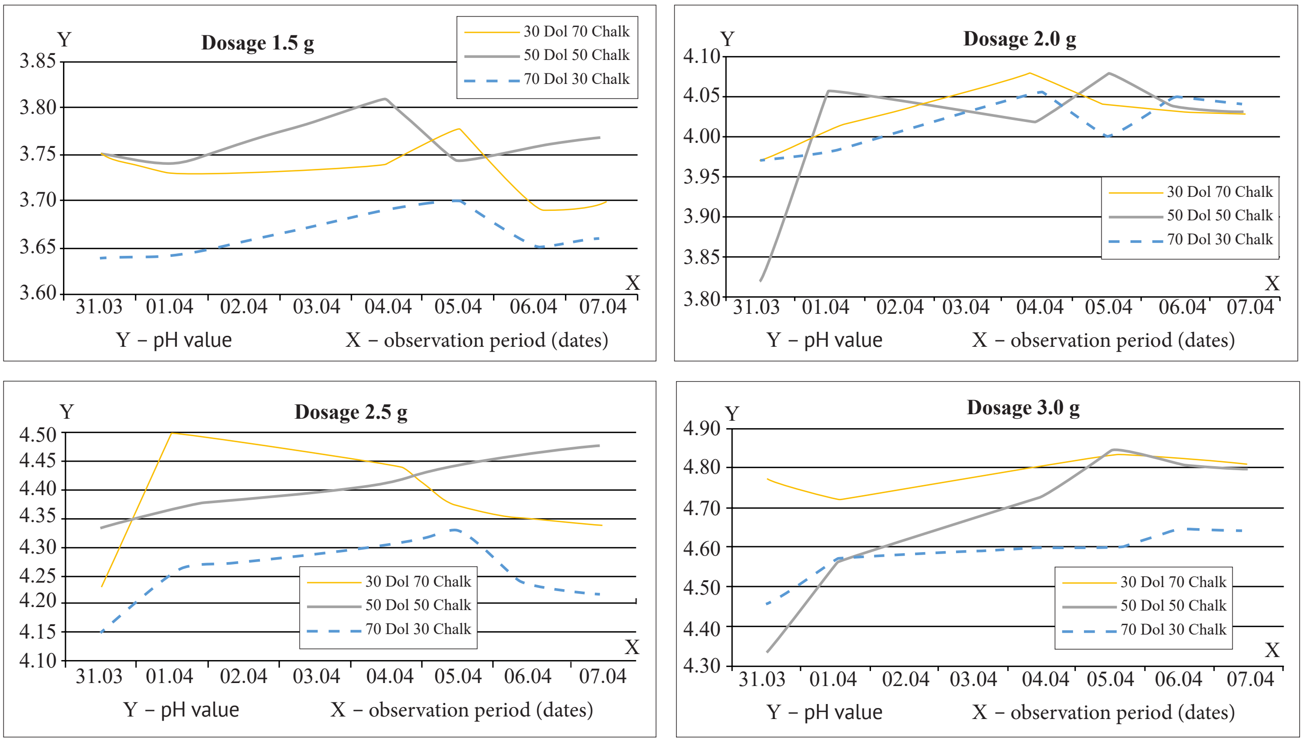

***Figure 4**. Dynamics of the change of substrate neutralisation with the use of different dosages of mixed lime material in different study periods*

An increase in the concentration of chalk in the neutralising material leads to a faster deoxidation of the substrate prepared based on cottongrass-sphagnous high-moor milled peat with a pH of 3.2 before neutralisation begins.

Chalk was used as a lime material. The peat under study is characterised as cottongrass-sphagnous, pH 3.2, humidity 50-60% per wet weighing batch (relative humidity). The results of the conducted analyses are shown in Table 2.

***Table 2**. The results of determining the actual acidity (pH_{KCl}) of high-moor peat at different rates of chalk application and duration of experiment*

The norm of chalk, kg/m³	Duration of experiment, days					
	1	3	5	7	9	14
2	4.1	4.1	4.2	4.3	4.4	4.4
4	4.4	4.5	4.7	4.9	4.7	4.7
6	5.1	5.2	5.3	5.4	5.1	5.4
8	5.3	5.8	6.1	6.8	6.7	6.6

***Source**: [6]*

According to the results of the conducted studies [6], it follows that the norms of its application from 2 to 8 kg/m³ were selected for the neutralisation of the peat substrate with chalk. With an increase in the chalk norm, the actual acidity of the peat substrate increases from pH_{KCl} 4.1 to pH_{KCl} 4.3-6.8. The dose of chalk application is calculated for 1 m³ of the substrate (Table 3).

***Table 3**. The required amount of chalk to be applied to the substrate*

Indicator name	Tree species			
	Spruce	Pine	Larch	Oak
Relative humidity of the peat substrate, Wh, %	50-60			
Acidity of the peat substrate, pH_{KCl}	4.0-5.0	4.5-5.5	5.5-6.0	5.5-6.5
Introduction of chalk into the peat substrate, kg/m³	2.5-4.5	3.5-5.5	5.5-7.5	5.5-8.0
Introduction of chalk into the peat substrate, kg/t	10-18	14-22	22-30	22-32

With humidity of 50-60% and natural addition, the specified volume of peat has a weight of about 250 kg. This calculation is given according to the recommendations [11] for the volume and weight of peat. According to the literature data [16] and the study by S.V. Suravyov [6], the amount of chalk applied should be more than dolomitic meal. The reaction of the medium in the peat substrate was established on day 7 when the substrate interacted with chalk. When applying chalk, the reaction of the medium in the substrate changes depending on the dose and the period of interaction of the substrate with the chalk.

Dolomitic meal of JSC "Dolomit" of various deposits (GOST 14050-93 [17]) and/or finely granulated chalk of JSC "Krasnoselskstroymaterialy" (TU RB 590118065.007-2004 [18]), ground separated chalk of JSC "Shebekinsky Melovoy Zavod" (GOST 12085-88 [19]), ground chalk for the production of compound feeds of JSC "Belarusskiy Cementnyy Zavod" (TU BY 700002051.001-2009 [20]) can be used as an additive in the neutralisation of peat substrate.

Table 4 shows the chemical composition of the dolomites of the Gralevo deposit (data from the manufacturer of JSC Dolomit). Raw materials from this deposit are used for the production of limestone (dolomite) meal GOST 14050-93, which is used for the production of substrates by the branch of the production republican unitary enterprise "Vitebskoblgaz" of the production department "Vitebsktorf".

***Table 4**. Chemical composition of dolomites from "Gralevo" deposit of JSC "Dolomite"*

Oxides	Fluctuations, %		The most typical values, %	Average value, %
	From	To		
SiO_2	0.39	13.37	1.0-2.0	1.65
Al_2O_3	0.10	1.79	0.2-0.5	0.37
Fe_2O_3	0.11	1.27	0.2-0.5	0.35
TiO_2	0.01	0.14	0-0.05	0.05
CaO	23.84	34.54	29.00-31.00	30.02
MgO	14.75	22.36	20.00-21.00	20.50
K_2O	0.02	0.64	0.05-0.20	0.13
Na_2O	0.03	0.24	0.03-0.10	0.05
SO_3	–	1.02	0-0.62	0.26
P_2O_5	–	0.17	0-0.03	0.03
MnO	–	0.11	0-0.05	0.02
Total	–	–	–	46.39
$CaCO_3$	47.0	58.0	50.0-52.0	51.0
$MgCO_3$	38.0	47.0	43.0-45.0	42.0
$CaCO_3$+ $MgCO_3$	85.0	99.8	93.0-96.0	95.0

It was found that when neutralised with dolomitic meal, the maximum pH value in the KCl of the peat substrate reaches 6.6, while when neutralised with chalk – 7.5. To determine the cause of this phenomenon, it is necessary to determine the qualitative and quantitative compositions of the neutralising additives used. The content of magnesium, calcium, water, and the amount of the residue insoluble in hydrochloric acid were determined in the starting substances. In the chalk, the sum of sesquioxides (Fe_2O_3) was additionally determined + Al_2O_3). In addition, the dolomites used and the insoluble residues obtained from them were studied by granulometric and X-ray phase analysis.

***Table 5**. Technical characteristics of limestone meal (dolomite) GOST 14050-93*

Indicator	Value
Total mass fraction of calcium and magnesium carbonates, %, not less	85.0
Mass fraction of moisture, %, not more	1.5
Grain composition, total residue on the sieve, %	–
5 mm, not more	–
3 mm, not more	1.0
1 mm, not more	3.0
The index of active ingredient, not less	81.0

The results of the analysis of samples of dolomitic meal from the PU Vitsebsktorf Oktyabrsky (sample 1), (PU Vitsebsktorf) Krulevschina (sample 2), (PU Vitsebsktorf) Obol (sample 3) are presented in Table 6 and Table 7.

***Table 6**. Results of the analysis of dolomitic meal of JSC "Dolomit"*

Component	Deposit		Sample 1	Sample 2	Sample 3
	Gralevo	Ruba			
$MgCO_3$, %	43.1	42.9	43.0	39.2	36.5
per MgO, %	20.5	20.5	20.5	18, 7	17.4
$CaCO_3$, %	53.6	53.4	43.7	55.4	48.4
per CaO, %	30.0	29.9	24.5	31.0	27.1
H_2O, %	0.3	0.1	0.26	0.42	0.15
Insoluble residue, %	3.2	3.0	2.7	3.5	2.1

***Table 7**. The results of the analysis of the chalk deposits Gralevo, Ruba, PU Vitsebsktorf*

Component	Chalk		
	Small-pelleted	Ground	
		For the production of feed compounds	Separated
$CaCO_3 + MgCO_3$ in terms of $CaCO_3$	95.57	91.87	98.00
$CaCO_3$, %	94.5	91.31	96.00
$Fe_2O_3 + Al_2O_3$	0.21	0.65	0.2
H_2O, %	0.48	0.6	0.42
Insoluble residue, %	1.98	5.11	1.3

Samples of dolomite from the Gralevo and Ruba deposits and three samples presented by the PU Vitebsktorf were used for the analysis. As can be seen from the analysis, dolomitic meal consists of a class of carbonates of the chemical composition $CaCO_3 \times MgCO_3$, while in accordance with regulatory documents, the total residue on the sieve of 1 mm or more is 25%, which indicates the size of dolomite particles of 0.1-1.5 mm. In turn, the basis of chalk is calcium carbonate with a small amount of magnesium carbonate and a slight admixture of the smallest quartz grains, while the residue on the 0.045 mm sieve does not exceed 5%, i.e., chalk is a finely dispersed material.

The particle size of the neutralising material affects the speed of the process: the smaller the particle size of the material, the larger the interaction surface of the phases (liquid–solid). Therefore, when adding chalk in the preparation of a peat substrate, the neutralisation process proceeds faster than when adding dolomitic meal. This can also explain the impossibility of obtaining a peat substrate with a pH_{KCl}=7 when using dolomitic meal. Organic acids entering the pores of a granular material (dolomitic meal) are blocked in the pores after a certain period of time due to the generation of products of the interaction of acids with calcium and magnesium carbonates. And they do not have access to the original neutralising additive. When selecting the consumption rate of a neutralising additive, it is necessary to rely not on the mass of limestone flour (dolomitic meal) GOST 14050-93, but on the total content of calcium and magnesium carbonates in terms of $CaCO_3$.

During the experiment on neutralising the peat substrate with chalk, 3 options were delivered in 3-fold repetition with a rate of application from 8 to 10 kg/m^3 using the PNT 3000 combi device. The use of chalk led to a gradual change in the acidity of the peat substrate from pH_{KCl} 2.5, EC – 0.05 mS/cm (milled peat from field 2A) to pH_{KCl} 6.4-7.5 and the establishment of a medium reaction on 6-7 days (Table 8). When conducting an experiment on the neutralisation of a peat substrate with dolomite, 3 options were delivered in 3-fold repetition with a rate of application from 8 to 10 kg/m^3.

***Table 8**. Actual acidity (pHKCl) and electrical conductivity of high-moor peat during neutralisation, taking into account the rate of application of chalk and dolomitic meal*

The norm of chalk, kg/m^3	pH_{KCl}		EC, mS/cm	
	Chalk	Dolomitic meal	Chalk	Dolomitic meal
6	6.4	5.9	0.08	0.06
8	7.5	6.4	0.09	0.06
10	7.5	6.6	0.10	0.07

The use of chalk led to a gradual change in the acidity of the peat substrate from pH_{KCl} 2.5, EC – 0.05 mS/cm (milled peat from field 2A) to pHKCl 5.9-6.6 and the establishment of the reaction of the medium on day 14. For an active experiment, milling peat (fraction from 0 to 7 mm) was taken. These data show that the change in the electrical conductivity of peat depends on the dose and type of neutralising material introduced (Table 9).

***Table 9**. Changes in the acidity and electrical conductivity of top separated peat when applying dolomitic meal*

Experiment option	Tree species	pH_{KCl}	EC, mS/cm
22.02 (the day of experiment)			
Milling peat + dolomitic meal 2 kg/m^3	European spruce	3.47	0.05
Milling peat + dolomitic meal 4 kg/m^3		4.04	0.05
Milling peat + dolomitic meal 3 kg/m^3	Scots pine	3.82	0.05
Milling peat + dolomitic meal 4.5 kg/m^3		4.34	0.05
27.02			
Milling peat + dolomitic meal 2 kg/m^3	European spruce	3.61	0.05
Milling peat + dolomitic meal 4 kg/m^3		4.48	0.05
Milling peat + dolomitic meal 3 kg/m^3	Scots pine	4.11	0.05
Milling peat + dolomitic meal 4.5 kg/m^3		4.79	0.05
13.03			
Milling peat + dolomitic meal 2 kg/m^3	European spruce	3.67	0.05
Milling peat + dolomitic meal 4 kg/m^3		4.68	0.05
Milling peat + dolomitic meal 3 kg/m^3	Scots pine	4.18	0.05
Milling peat + dolomitic meal 4.5 kg/m^3		5.07	0.05

Initially, the milled peat from field 2A had an electrical conductivity of 0.05 mS/cm. When applying chalk: 6 kg/m^3, the electrical conductivity increases by 1.6 times (0.08 mS/cm), 8 kg/m^3 – increases by 1.8 times (0.09 mS/cm), 10 kg/m^3 – increases by 2.0 times (0.10 mSm/cm). The introduction of dolomitic meal in a dosage of 6-8 kg/m^3 changes the electrical conductivity by 1.2 times (0.06 mS/cm), and 10 kg/m^3 – by 1.4 times (0.07 mS/cm).

Compared with chalk, dolomitic meal at a rate of application of 6-10 kg/m^3 has a lesser effect on the change in the electrical conductivity of the high-moor peat. To conduct an experiment on neutralising the peat substrate with dolomite and changing the electrical conductivity, 4 options were studied in 3-fold repetition with a rate of application from 2 to 4.5 kg/m^3. The milled peat from field 2A was taken (bulk density at relative humidity (Wrel) 60% – 238 kg/m^3, actual acidity (pH_{KCl}) – 2.5, electrical conductivity (EC) – 0.05 mS/cm The experimental data show that the introduction of dolomitic meal from 2 to 4.5 kg/m^3 into the milled peat during neutralisation does not lead to a change in the electrical conductivity of the peat.

CONCLUSIONS

Thus, according to the study results, it was found that with an increase in the dosage of mixed lime material (2.5 g and 3.0 g per 125 g of peat), the neutralisation of the substrate naturally increases. The equalisation of the neutralising ability of the mixed lime material occurs approximately on day 7-8 at a dosage of 1.5-2.5 g per 125 g of peat and on day 5-6 at a dosage of 3.0 g per 125 g of peat. Moreover, at a lower dosage, after an increase in the pH value, a certain decline occurs at the end of neutralisation.

An increase in the concentration of chalk in the neutralising material from 30% to 70% leads to a faster deoxidation of the substrate, which is conditioned by the fact that the reaction of the medium in the peat substrate is established after a 10-day interaction with dolomitic meal and a 7-day interaction with chalk.

It was found that when neutralised with dolomitic meal, the maximum pH value in the KCl of the peat substrate reaches 6.6, while when neutralised with chalk – 7.5. These studies have shown that the change in the electrical conductivity of peat during the cultivation of Scots pine depends on the dose and type of neutralising material introduced. Initially, the milling peat had a conductivity of 0.05 mS/cm, but with the introduction of chalk at 6-8 kg/m^3, its electrical conductivity increases 1.6-2.0 times (0.08-0.10 mS/cm, and the introduction of dolomite in a dosage of 6-10 kg/m^3 changes the conductivity of 1.2-1.4 times (0.06-0.07 mS/cm). Compared with chalk, dolomitic meal with a rate of application of 6-10 kg/m^3 has a lesser effect on the change in the electrical conductivity of high-moor peat. The introduction of dolomitic meal in a dosage from 2 to 4.5 kg/m^3 into the milled peat (acidity (pH_{KCl}) – 2.5, electrical conductivity (EC) – 0.05 mS/cm) during neutralisation does not lead to a change in the electrical conductivity of the peat substrate (when growing European spruce).

When carrying out the neutralisation of milling peat (pH in KCl – 2.5), the introduction of the dolomite in dosages of 2-4 kg/m3 (European spruce), 3-4.5 kg/m^3 (Scots pine) allows achieving optimal acidity within a month of finding the substrate in the greenhouse and before the emergence of woody plants. According to TU BY 100061961.001-2015, the optimal acidity of the substrate for growth of European spruce is pH in KCl 4.0-5.0; for Scots pine – pH in KCl 4.5-5.5. As a result of experiments, it was possible to achieve neutralisation of the peat substrate when applying dolomitic meal at a dosage of 5.8-10 kg/m^3 only up to a pH in KCl of 4.9-5.4. Increasing the dose of application of dolomitic meal to 11-14 kg/m^3 allows reaching a pH of 6.0-6.1 in KCl after a month in the greenhouse. The use of large doses of dolomite does not significantly or practically affect the change in the acidity of the peat substrate.

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Вплив нейтралізуючих матеріалів на реакцію середовища торф'яного субстрату при вирощуванні сіянців із закритою кореневою системою

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Анотація. Використання різних видів нейтралізуючих матеріалів при вирощуванні стандартного посадкового матеріалу лісових деревних видів високої якості істотно впливає на кислотність субстрату. Тому авторами статті було поставлено за мету підібрати торф'яні субстрати з різним дозуванням нейтралізуючої складової і визначити вплив їх на реакцію середовища торф'яного субстрату. У представленій статті наведені результати впливу нейтралізуючих матеріалів доломітового борошна і крейди різних доз із застосуванням мінеральних добрив. Як нейтралізуючий компонент використовувалося доломітове борошно pH торф'яного субстрату – 6,6 і крейди – 7,5. Встановлено, що при нейтралізації торф'яного субстрату, створеного на основі верхового торфу фрезерної заготівлі (pH 2,5) із внесенням доломітового борошна дозами 2–4 кг/м^3 (ялина європейська), 3–4,5 кг/м^3 (сосна звичайна), оптимальної кислотності можна досягти через місяць. Авторами статті було зафіксовано збільшення концентрації вапняного матеріалу, що призводить до збільшення нейтралізації субстрату при дозі 2,5 г і 3,0 г на 125 г торфу. Кращі показники продемонстрували варіанти доз 1,5–2,5 г на 125 г торфу при 7–8-денному використанні і дозуванні 3,0 г на 125 г торфу на 5–6 день у порівнянні з контролем. Збільшення концентрації крейди в нейтралізуючому матеріалі від 30 % до 70 % призводить до більш швидкому розкисленню субстрату (pH 3,2), а при підвищенні дозування крейди збільшує нейтралізацію субстрату. Електропровідність субстрату в дозуванні 6–8 кг/м^3 при внесенні крейди і доломітового борошна збільшується в 1,6–2,0 і 1,2–1,4 рази відповідно. При нормі внесення 6–10 кг/м^3 чинить менший вплив на зміну електропровідності верхового торфу, а внесення доломітового борошна 2–4,5 кг/м^3 в торф фрезерної заготівлі в процесі нейтралізації не призводить до зміни електропровідності торфу. Зазначені наукові знання дозволяють підібрати нейтралізуючі матеріали певної концентрації, які дозволять вирощувати стандартний посадковий матеріал європейської якості і тим самим забезпечать належну якість майбутніх деревостанів

Ключові слова: кислотність середовища, посадковий матеріал, доломітове борошно, крейда, торф, субстрат