Dina Karpova [1], Natalia Chizhikova [2], Tatyana Trifonova [1],
Natalia Starokozhko [1], Victoria Hadiushina [1]

POTASSIUM RESERVE IN SOILS OF THE VLADIMIR OPOLYA FROM A POSITION OF THE CONTENT OF MINERALS - BEARIERS OF NUTRIENT ELEMENTS FOR PLANTS

[1] *Lomonosov Moscow State University, Faculty of soil science, Moscow, Russia,*
karpovad@mail.ru , Tel : +74959393333

[2] *V. V. Dokuchaev Soil Science Institute, Moscow, Russia*

Abstract. The aim of the study is estimation of potassium reserves of agrogrey heavy clay loam soil of Vladimir opolie on the basis of differentiated analysis of its contents in fractions less than 1, 1-5, 5-10 microns. The object of research is agrogrey heavy clay loam soils of a trench created on the loess loam. Minimum content of aluminum and iron as well as the greatest amount of silicon oxide is noted in the plough layer. The latter could be explained by involvement of eluvial part of natural soils. The content of elements oxides in oozy fraction significantly differs from that of the bulk soil. The amount of silicon oxide is sharply reduced whereas the way of its distribution on a profile is uniform (49.5-51.2 %). Significant increase in iron and aluminum oxides content (10.1-11.1 % and 18.2-19. 1 %, respectively) is noted. In comparison with the bulk soil the oozy fraction is enriched with gross magnesium. The amount of calcium oxide potassium oxide content in silt is only slightly greater than its quantity in the soil as a whole. The gross chemical composition of oozy fraction indicates that this fraction consists mainly of clay minerals characterized by high amounts of aluminum, iron, magnesium and potassium. The main components of fraction are irregular mixed-layered units, mica – smectites with the high contents of smectite packages dominate. Smectite phase and hydromicas comprise 85-90 % of the sum of silt components. The amount of kaolinite and chlorite fluctuates within 10-15 %. These minerals are sources of potassium, magnesium and determine soil anions behavior. Reserves of potassium in oozy fraction is the highest in comparison with fractions of a fine and medium dust as the main potassium carriers are minerals comprising more than 80 % of all minerals of fraction. Thus, the greatest amount of such nutrients as potassium, phosphorus, magnesium is fixed in fine fractions, in the oozy – phosphorus, and magnesium, in oozy and fine-dust fraction – potassium, magnesium. Periodic addition of part of illuvial horizon during plowing is necessary for compensation of natural nutrients stocks. The last prevents textural differentiation of a profile, fills up number of fine fractions along with elements of plant nutrition.

Keywords: Potassium reserve, agrogrey soil.

INTRODUCTION

The knowledge of the soil mineralogical composition and the crystallochemistry of the main rock-forming minerals are necessitated by the vital need to study the value and nature of potential and effective fertility. They characterize the total storage of nutrient elements and their possible mobilization in the case of taking up by the vegetation communities.

Since the time of V.V. Dokuchaev's publications many fundamental works have been written to show the role of the mineralogical composition in the soil fertility.

To study the behavior of nutrient elements containing in minerals, numerous experimental works have been carried out by Russian scientists (Pryanishnikov, 1903; Chirikov, 1916; Peterburgskiy, 1973; Vazhenin, 1975, etc.). The obtained results serve as evidence of a direct connection between the minerals, their crystallochemistry, the dissociation degree and the availability of nutrient elements to plant communities.

There are various approaches to assess the storage (reserve) of nutrient elements. Gorbunov (1969, 1978) offered the differentiated assessment of such reserves containing in minerals. Each element is concentrated in certain minerals. For example, potassium - in feldspar, mica, hydromica; magnesium – in biotite, chlorite, vermiculite, etc., phosphorus - in apatite, phosphates of potassium, calcium, etc., and also in the state absorbed by clay minerals. The total storage of elements is divided by N.I.Gorbunov into four categories: general, potential, near, direct.

Of great interest is the information on the potassium reserve because the behavior of this element is directly connected with the presence of minerals-beariers of potassium. The differentiated approach to an assessment of nutrition reserves containing in minerals, had a wide resonance both among the researches in Russia, and in the other countries: Belarus (Kulakovskaya, 1974; Sergeenko, 1984), Moldova (Alekseev, 1985), in the Crimea (Gusev and Polovitsky, 1985), Azerbaijan (Mamedov and Iskanderov, 1985), Uzbekistan (Gaipova et al. 1985). This problem was discussed in a number of symposiums and international meetings, such as "Increase of fertility of soils and clay minerals" (Chekhoslovakia, 1978), "Mineralogy of soils and their fertility", (Moscow, 1988), "Fertility models". (Moscow, 1987), "Clay minerals and acid precipitation" (Tte World Soil Science Congress, Monpelye, France, 1998).

In the publication of Chizhikovaet et al. (1990) is has been established that the various forms of potassium compounds are closely connected with the mineralogical composition of light-textured soils in Pskov, Novgorod, Leningrad, Vologda, Kalinin, Yaroslavl, Kostroma regions, as well as in sandy deposits at the territory of Vladimir, Ryazan and Moscow Meshcher.

A number of minerals was offered by Gradusov and Chizhikova (1988) to show their possibility to mobilize the potassium in the course of the soil formation and provision of plants with this nutrient element according to increasing their stability degree to the weathering and pedogenesis agents: (1) biotite, phlogopite, (2) mixed-layered biotite (phlogopite) – vermiculite and hydrobiotite in particular, (3) glauconite and mixed-layered mica-smectite, (4) muscovite, sericite, dioctahedral hydromica, (5) orthoclase, microcline.

In agriculture especially with mineral fertilization it is very important to specify the fixing capacity of minerals. The presence of minerals actively reacting with elements containing in the fertilizers determines the dynamics of their behavior in soil. Thus, according to the ability to fix the potassium and ammonium it is advisable to distinguish the minerals and mixed-layered compounds that are the following: 1) vermiculite 2) mixed-layered biotite (phlogopite) – vermiculite, 3) chlorite-vermiculite, 4) chlorite-smectite, 5) mixed-layered mica-smectite, 6) mixed-layered muscovite (sericite)-smectite, 7) smectite , 8) kaolinite-smectite.

In the given paper an effort has been undertaken to estimate the reserves of plant nutrients in agro-gray heavy loamy soils of Vladimir Opolye as based upon the differentiated analysis of the content of several elements and the crystallochemistry of minerals in the fractions less than 1, 1-5, 5-10 μm.

MATERIAL AND METHODS

The object of research are agro-gray heavy loamy soils derived from the loess-like loams in the transect prepared for participants of III Congress of the Dokuchaev Soil Science Society (Guidebook of scientific field trip, Suzdal, 2000). The transect is located in plane well-drained conditions (near the Mshara ravine), stretching from the south to the north in the southern part of the territory under study.

In this catena the soils reveal the medium-heavy loamy and clay-silty composition in the upper part of the profile and the coarse silt-clayey one in the lower horizons. Our data on the particle size distribution in the studied soils defined by Gorbunov's method (1971) well agree with those, obtained by Kachinskiy.

RESULTS AND DISCUSSION

The total chemical composition of these soils is characterized by the clearly expressed differentiation of the profile according to the content of silicon and iron oxides with aluminum as a result of soil formation. In the plough horizon there is a higher content of silicon oxide resulted from involving the eluvial part of natural soils as well as the minimum content of aluminum and iron. Noteworthy is the fact the amount of calcium oxide and phosphorus is the greatest in the arable horizon, what is thought to be a result of amendment and fertilizer application, that is a response to technogenic effects.

Table 1 - The total chemical composition of agro-gray soils in Vladimir Opolye and the fractions extracted from them, %

Depth, cm	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	K_2O	TiO_2	P_2O_5	MnO	Cr_2O_3	SO_3	Cl
						Soil						
0-10	73,94	11,18	3,90	1,44	0,76	2,57	0,90	0,18	0,13	0,02	0,13	0,01
40-50	66,98	13,88	5,57	1,19	0,98	2,66	0,92	0,03	0,10	0,02	0,04	0,02
80-90	66,52	13,67	5,37	1,26	1,14	2,57	0,91	0,04	0,09	0,02	0,06	0,02
200-210	66,04	14,57	5,54	1,07	1,37	2,53	0,91	0,06	0,09	0,02	0,07	0,01
						Fraction less than 1 μm						
0-10	49,51	18,65	10,10	0,33	2,14	2,75	1,02	0,26	0,18	0,03	0,12	0,14
40-50	50,62	19,05	11,10	0,22	2,12	2,75	1,00	0,09	0,11	0,03	0,05	0,04
200-210	51,20	18,20	10,38	0,45	11,98	2,64	0,95	0,01	0,12	0,04	0,06	0,04
						Fraction 1-5 μm						
0-10	67,54	13,16	5,58	0,69	1,04	3,31	1,09	0,08	0,23	0,02	0,11	0,04
40-50	71,93	13,80	4,65	0,57	1,24	3,35	1,07	0,04	0,12	0,02	0,06	0,06
200-210	62,26	15,21	7,17	1,00	1,40	3,06	1,12	0,02	0,13	0,03	0,03	0,05
						Fraction 5-10 μm						
0-10	80,72	10,05	2,94	0,87	0,92	2,65	0,88	0,02	0,14	0,013	0,04	0,02
200-210	73,62	12,56	3,95	1,50	1,32	2,76	0,94	0,01	0,11	0,015	0,05	0,03
						Fraction > 10 μm						
0-10	81,49	8,49	2,39	0,98	0,61	2,29	0,81	0,01	0,08	0,011	0,04	0,03
200-210	73,82	7,85	2,59	1,65	0,63	1,97	0,74	0,01	0,05	0,015	0,08	0,01

In the distribution of the total potassium there is differentiation what is probably connected with anthropogenic loads. The magnesium amount increases downwards the profile. The titanium oxide is uniformly distributed throughout the profile. The greatest amount of manganese oxide is observed in the upper part of the profile.

Our data about the content and distribution of mineral oxides in the profile are similar to those presented in literature (Rubtsova, 1974; Dubrovina, 1993, Ivanov et al. 2000).

The content of mineral oxides in the clay fraction is significantly different from that observed in the soil. The amount of silicon oxide is sharply reduced, being uniformly distributed throughout the soil profile (49,5-51,2 %). At the same time, there is a significant increase in the iron and aluminum oxides (10,1-11,1 % and 18,2-19,1 % respectively). As seen from table 1, they are evenly distributed. In comparison to the soil the clay fraction is enriched with the total magnesium what is explained by the presence of Mg-containing minerals just in this fraction. The amount of calcium oxide is insignificant and speaks about a small admixture of calcium-bearing minerals. The potassium oxide in clay doesn't almost exceed its amount in the soil.

It should be noted that the phosphorus content in the clay fraction extracted from the plough horizon is exceeding its amount in soil by 2 times. The latter indicates that the phosphorus in the fertilizers introduced into the soils is absorbed by components of clay fractions.

The described total chemical composition of the clay fraction is conditioned by the mineralogical composition represented predominantly by clay minerals, which are rich in aluminum, iron, magnesium and potassium.

The main components of this fraction are the complicated disordered mixed-layered formations, in which are dominant - mica-smectite with a higher content of smectite packets. These formations are named as a smectite or swelling phase. The other components are hydromica represented by a mixture of dioctahedral and trioctahedral types, imperfect kaolinite and Mg-Fe chlorite .

The soil profile is differentiated according to the distribution of the major mineral fractions less than 1 μm. The upper part of the profile is relatively depleted by the smectite phase, the amount of which varies from 43.2 to 54.6 % (table 2). In the lower part of the profile (at a depth of 80 cm and lower) the amount of smectite phase increases and its content varies from 57.2 to 72.1 %. The hydromica distribution in the profile is also differentiated. The maximum amount is in the upper part (44.2 %) whereas the minimum – in the lower part of the profile (19.8 %). The above minerals are a source of potassium and magnesium as the most important nutrients for plants.

Table 2 - The ratio between the main mineral phases of the clay fraction (<1 μm) in agro-gray heavy loamy soil

	Depth, cm	Clay content in the fraction < 1 μm	Kaolinite +chlorite	Hydromica	Mixed-layered formations	In soil		
						Kaolinite +chlorite	Hydromica	Mixed-layered formations
1	0-10	16,5	8,9	36,1	54,8	1,5	5,9	9,0
2	10-20	15,5	11,8	44,2	44,0	1,8	6,9	6,8
3	30-40	10,0	12,8	44,0	43,2	1,2	4,4	4,3
4	40-50	31,0	7,2	38,2	54,6	2,4	11,8	16,9
5	50-60	31,5	8,0	43,8	48,3	2,5	13,8	15,2
6	80-90	18,9	7,3	26,6	66,0	1,4	5,0	12,5
7	100-110	27,8	8,8	33,9	57,2	2,4	9.1	16,1
8	200-210	23,1	8,1	19,8	72,1	1,8	3,0	16,7

In the fine silt fraction the increase in the silicon oxide is fixed and its quantity is close to that contained in the soil (table 1). Specific is a soil sample taken at a depth and of 40-50 cm, its amount of silicon oxide is the highest (71.9 %). There is a little differentiation of aluminum and iron oxides throughout the profile. This fraction is characterized by a higher content of potassium oxide, what is explained by the mineralogical composition, in which the main components are micas and K-feldspars. The amount of phosphorus oxide dramatically reduced as compared to its content in the clay fraction, but it is rather high in the plough horizon. When analyzing the calculation of potassium reserves in the fine silt fraction, it is possible to observe a decrease in its content as compared to the soil due to a lower amount of this fraction. However, it can be considered as a source of potassium, because this fraction contains mica and K-feldspar resulted from such processes as weathering and mechanical disintegration of mineral grains. The mineral composition of this fraction is substantially differed from that in the silt fraction (table 3). Drastically reduced (to 2.2 %) is the amount of mixed-layered formations, the quartz content becomes higher (25.6 %), K-feldspat - to 21.8 % and 15.4% of plagioclase. Among the layered silicates the mica is diagnosed, the amount of which reaches 29.7%, kaolinite - 10.4 %, chlorite - 6.3 %. The potassium sources are here micas and K- feldspars, being in the sum they reveal a higher percentage of total potassium in the fraction. Chlorite is a source of magnesium.

A relative increase in the content of silty quartz, feldspar and plagioclase was fixed in the upper part of the profile. This phenomenon is probably conditioned by a more intensive mechanical disintegration of grains in the above minerals.

Table 3 - The composition of minerals in the fine silt fraction (1-5 μm) of the agro-gray heavy loamy soil

Horizon	Depth, cm	Content in the fraction, %							
		Fine silt	Smectite	Mica	Kaolinite	Chlorite	Feldspat	Plagioclase	Quartz
Апах	0-20	7,7	2,2	27,9	4,1	2,9	21,8	15,4	25,6
Апах	10-20	10,0	2,5	25	6,9	5,1	21,5	14,3	24,6
ELB	30-40	8,8	4,9	28,4	8,6	4,5	18,7	9,9	21,8
B1	40-50	9,5	5,2	28,8	8,2	4,2	18,8	14,2	20,7
B1	50-60	9,5	5,7	28,7	10,1	4,7	19,3	11,5	19,8
Bca	80-90	12,9	14,4	29,7	11,4	3,5	11,9	9,2	19,6
Bca	100-110	11,2	14,4	26,9	10,1	5,1	11,7	10,8	20,9
Cca	200-210	16,0	18	25	10,8	6,2	11,9	9,6	18,5

Horizon	Depth, cm	% to the soil						
		Smectite	Mica	Kaolinite	Chlorite	Feldpast	Plagioclase	Quartz
Апах	0-20	0,2	2,2	0,3	0,2	1,7	1,2	2,0
Апах	10-20	0,3	2,5	0,7	0,5	2,2	1,4	2,4
ELB	30-40	0,4	2,7	0,6	0,4	1,7	0,9	1,9
B1	40-50	0,5	2,8	0,6	0,4	1,8	1,3	2,0
B1	50-60	0,6	2,8	1	0,5	1,8	1,0	1,9
Bca	80-90	1,8	3,9	1,4	0,5	1,5	1,2	2,6
Bca	100-110	1,6	3,0	1,4	0,6	1,3	1,2	2,4
Cca	200-210	2,9	4,0	1,6	1	1,9	1,6	2,9

The ratio between 1.0 nm and 0.5 nm of mica reflex intensities indicates the absence of any differences in the ratio of di-and trioctahedral differences within the profile. The ratio between the intensity of mica reflex in 1.0 nm and the intensity of quartz reflex 0.334 nm shows a higher content of quartz in the upper horizons. Thus, the silt fraction seems to be different from clay one. It is dominated by quartz and mica, followed by K- feldspar and plagioclase.

The fraction of medium dust (5-10 μm) is only 4,8-10,1 % from the sum of all the fractions. It is evenly distributed (table 4). Its slightly expressed increase is observed in the topsoil.

Table 4 - Mineralogical composition of the fraction of medium dust (5-10 μm) in agro gray heavy loamy soil (%)

Horizon	Depth	Content of the fraction 5-10 μm	Quartz	Feldspat	Plagioclase	Mica
A_{arab}	0-20	13,1	25	26	19	21
A_{arab}	10-20	7,7	22	31	25	17
ELB	30-40	6,1	22	29	22	19
B1	40-50	7,1	21	27	18	25
B1	50-60	7,1	25	25	20	19
Bca	80-90	6,0	36	17	18	19
Bca	100-110	6,8	40	15	18	19
Cca	200-210	6,4	30	23	21	18

The main components of the fraction are quartz, K- feldspar, plagioclase, mica (table 4). These components within the profile are subdivided into two parts - the upper with the highest content of K-feldspar, plagioclase and the lower part, in which quartz is dominated (30-40 %) (table 4).

According to the total composition of oxides this fraction is significantly differed from the above mentioned ones.

The content of silica oxide in the fraction of medium dust reaches 80.7 %. The amount of iron and aluminum oxides is reduced to 10 % and 2.9 % respectively. The same pattern is characteristic of potassium, phosphorus, magnesium, calcium. The reduction of the amount of total potassium oxide in this fraction is evidenced by the calculation data about the content of minerals. The mica content is significantly decreased in this fraction, but the amount of K-feldspars is higher, i.e. the behavior of potassium is quite another and it becomes less available.

The fraction > 10 μm displays the highest values of silicon and the lower content of all the oxides. The amount of iron oxide accounts for 2.4 %, magnesium and potassium - 0.6 % and 2.3 % respectively.

Thus, the analysis to determine the content of elements in fractions and to diagnose the bearers of these elements permits to conclude that the greatest amount of nutrients is found to be in clay and fine silt fractions.

Table 5 shows that in the studied soils the total reserve of potassium is the highest, somewhat little is the near reserve (figure 1). The direct reserve speaks about the average provision of soils with mobile potassium. Consequently, the crops requiring potassium as a nutrient element will be in need of potassium fertilizers.

Table 5 - Potassium stocks in the agro gray heavy loamy soil of Vladimir Opolye

Depth, cm	Fraction < 1 μm, %	Content of K_2O, %		Reserve, mg/100 g			
		Soil	Fraction < 0,001 мм	Potential	Near	Direct	General
0-10	16,5	2,57	2,75	2100	454	16	2570
40-50	31	2,66	2,75	1796	852	12,4	2660
80-90	18,0	2,57	2,75	2075	495	8,2	2570
200-210	25,1	2,53	2,66	1916	614	8,8	2530

Using the method proposed by N.I.Gorbunov (1969, 1974) we will try to show the distribution of total potassium in the fractions (table 6).

Table 6 - Potassium distribution in fractions of the agro gray heavy loamy soils in Vladimir Opolye

Depth,cm	Clay content	Content of K_2O in clay	K_2O reserve in soil	Content of fine dust	Content of K_2O in fine dust	K_2O reserve in fine dust	Content in medium dust	K_2O In medium dust	K_2O reserve in medium dust	Content of fraction >10 μm	K2O Content in fraction >10 μm	K2O reserve n fraction >10 μm
	%		mg/100g	%		mg/100g	%		mg/100g		%	
0-20	16,5	2,75	432	7,7	3,3	254	10,1	2,65	260	71,1	2,3	1633
30-40	31,0	2,75	837	9,5	3,3	313	7,1	2,68	182	52,5	2,1	1092
200-210	20,1	2,64	609	16,0	3,1	496	6,0	2,79	168	54,7	2,0	1273

The table shows that the reserves of potassium in the clay fraction are the highest as compared to the fractions of fine and medium dust because the main bearers of potassium are components make up > 80 % of all fraction minerals. The most dynamic and active functioning component of clay are the mixed-layered formations, which are not only a source of potassium as a result of its mobilization from the crystal lattice, but also play a significant role in the potassium absorption, potassium fertilizers introduced into soil and potassium in natural turnover of elements in the course of soil formation and weathering processes. It should be noted that the reserve of potassium in the clay fraction is also differentiated throughout the soil profile due to differentiation of the fraction (table 6) The table shows that the reserves of potassium clay fraction, the highest compared to the fractions and the average fine dust as the main carrier of potassium are the components that make up > 80 % of the mineral fraction. The most dynamic and active functioning component of sludge are mixed- education, which are not only a source of potassium as a result of the mobilization of its crystal lattice , but also play a major role in the absorption of potassium , and potassium fertilizer application of the natural cycle of elements in the processes of soil formation , weathering. It should be noted that the reserve potassium clay fraction is also differentiated by the soil profile by differentiating itself amount fraction (table 6) .

CONCLUSION

Calculation of the distribution of mineral oxides in the fractions allows concluding that the studied soils reveal the high potential fertility. The greatest amount of such nutrients as potassium, phosphorus, magnesium is fixed in fine dispersed fractions, phosphorus and magnesium - in the clay fraction and potassium and magnesium - in the fraction of fine dust. The clay fraction is most functional and may be considered not only as a source of these elements, but also as a regulator of behavior of these elements.

Agrotechnogenic effects leading to the soil acidification contribute to active destruction of K-bearing minerals, whereby the level of its amount in the soil solution increases, but at the same time the natural resources become declined.

To enrich the natural stocks of nutrients, it is necessary to carry out periodically the plowing of the illuvial horizons. The latter is capable to prevent the texture differentiation of the profile, promote increasing the amount of fine-dispersed fractions and hence the natural stocks of nutrients in soil. As a component it is actively reacted with the substances of the applied fertilizers and amendments. Potassium and ammonium are fixed by the lattice of mixed-layered minerals.

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РЕЗЮМЕ

Д. Карпова[1], Н. Чижикова[2], Т. Трифонова[1], Н. Старокожко[2], В. Хадюшина[1]

РЕЗЕРВ КАЛИЯ В ПОЧВАХ ВЛАДИМИРСКОГО ОПОЛЬЯ С ТОЧКИ ЗРЕНИЯ МИНЕРАЛОВ, СОДЕРЖАЩИХ ПИТАТЕЛЬНЫЕ ЭЛЕМЕНТЫ ДЛЯ РАСТЕНИЙ

[1]Московский государственный университет им.Ломоносова, факультет почвоведения, Москва, Россия, karpovad@mail.ru , Тел : +74959393333

[2]Институт Почвоведения им. В. В. Докучаева, Москва, Россия

Целью работы была попытка оценить резервы калия агросерых тяжелосуглинистых почв Владимирского ополья на основе дифференцированного анализа содержания его во фракциях размерностью менее 1, 1-5, 5-10 мкм.

Объектом исследования являются агросерые тяжелосуглинистые почвы, сформированые на лессовидных суглинках. В пахотном горизонте отмечается наибольшее количество оксида кремния как результат вовлечения элювиальной части естественных почв, а также минимальное содержание алюминия и железа. Содержание оксидов элементов в илистой фракции существенно отличается от такового почвы в целом. Резко снижено количество оксида кремния, и характер его распределения по профилю равномерный (49,5-51,2%). Отмечается значительное увеличение оксидов железа и алюминия (10,1-11,1%), (18,2-19,1%) соответственно. По сравнению с почвой, илистая фракция обогащена валовым магнием. Количество оксида кальция незначительно. Оксид калия в иле не намного превышает его количество в почве в целом.

Валовой химический состав илистой фракции свидетельствует о том, что эта фракция состоит преимущественно из глинистых минералов, для которых характерны высокие количества алюминия, железа, магния и калия.

Основными компонентами фракции являются сложные неупорядоченные смешанослойные образования, доминирует слюда – смектиты с высоким содержанием смектитовых пакетов. Смектитовая фаза и гидрослюды составляют в сумме 85-90% от суммы компонент ила. Количество каолинита и хлорита колеблется в пределах 10-15 %. Эти минералы являются источниками калия, магния, определяют поведение анионов в почве.

Профильная дифференциация серых почв обусловлена дифференциацией илистого материала, а в ней - смектитовой фазы, количество которой в нижней части профиля на 10-20 % выше, чем в элювиальной ее части. Особенно четко эта дифференциация минералов установлена при пересчете на почву в целом. Резервы калия илистой фракции наиболее высокие по сравнению с фракциями тонкой и средней пыли, поскольку основным носителем калия являются компоненты, составляющие > 80 % от всех минералов фракции.

Таким образом, наибольшее количество таких элементов питания, как калий, фосфор, магний фиксируется в тонкодисперсных фракциях, в илистой – фосфора, и магния, в илистой и тонкопылеватой – калия, магния. Илистая фракция наиболее функциональна вследствие не только как источник этих элементов, но также как регулятор поведения элементов, вносимых с удобрениями (мелиорантами) за счет фиксации этих элементов решеткой минералов.

Агротехногенные воздействия, приводящие к подкислению почв, способствуют активизации разрушения минералов калия – носителей, за счет чего уровень его количества в почвенном растворе увеличивается, но одновременно снижаются природные запасы. Для восполнения природных запасов элементов питания необходима периодическая припашка иллювиальных горизонтов. Последнее

предотвращает текстурную дифференциацию профиля, пополняет количество тонкодисперсных фракций, а с ними элементами питания растений.

Ключевые слова: резерв калия, агро-серые почвы.

ТҮЙІН

Д. Карпова[1], Н. Чижикова[2], Т. Трифонова[1], Н. Старокожко[2], В. Хадюшина[1]

ВЛАДИМИРЛІК ОПОЛЬЕ ТОПЫРАҒЫНЫҢ ӨСІМДІКТЕР ҮШІН ҚҰНАРЛЫ ЭЛЕМЕНТТЕРІ БАР МИНЕРАЛДАРДЫ ҚАМТУ ТҰРҒЫСЫНАН АЛҒАНДАҒЫ КАЛИЙ ҚОРЫ

[1]Ломоносов атындағы Мәскеу мемлекеттік университеті, топырақтану факультеті, Мәскеу, Ресей, karpovad@mail.ru , Тел : +74959393333

[2]В. В. Докучаев атындағы топырақтану институты, Мәскеу, Ресей

Зерттеудің мақсаты үлестегі кемінде 1, 1-5, 5-10 микрон калий құрамын саралай талдау негізінде Владимирлік табиғат аймағындағы сұр ауыр балшықты саз жерлеріндегі калий қорын бағалау болып табылады. Зерттеу нысаны сазды сарғыш топырақта қалыптасқан атыздардағы сұр ауыр балшықты жерлер болып табылады. Жердің жыртылған қабатынан алюминий мен темірдің аздаған бөлігі, сондай-ақ кремний тотығының көп мөлшері анықталды. Мұны табиғи топырақтың элювиалды бөлігінің қатысуымен түсіндіруге болады. Лайлы түйірлерде элемент тотықтарының болуы топырақтың негізгі массасынан біршама ерекшеленеді. Кремний тотығының саны күрт азаяды, бұл кезде ол бағыт бойынша тең таралады (49.5-51.2 %). Темір мен алюминий тотығының біршама артқаны байқалады (10.1-11.1 % және 18.2-19. 1 %). Топырақтың негізгі мөлшерімен салыстырғанда, лайлы қабат магниге бай. Тұнбада кальций тотығының саны мен калий тотығының құрамы жалпы топырақтағы жалпы санына қарағанда біршама жоғары.

Лайлы қабаттың жалпы химиялық құрамы бұл қабат негізінен алюминий, темір, магний, калидің көп болуымен сипатталатын балшықты минералдардан тұратынын көрсетеді. Қабаттың негізгі компоненттері жүйелі емес аралас қабаттар болып табылады және смектитті топтардың жоғары қамтылуымен смектиттер – слюдалар басым келеді. Смектитті қабат пен гидрослюда лай компоненттерінің 85-90 %-ын қамтиды. Каолинит пен хлорит саны 10-15 % мөлшерінде ауытқиды.

Бұл минералдар калий, магний көздері болып табылады және топырақтағы аниондар қалпын анықтайды. Лайлы қабаттағы калий қоры ұсақ және орташа тозаң үлесімен салыстырғанда ең жоғары болып табылады, өйткені калиді негізгі тасымалдаушы түйірдегі барлық минералдың 80 %-дан астамын қамтитын минералдар болып табылады.

Осылайша, калий, фосфор, магний секілді құнарлы заттардың ең көп мөлшері ұсақ түйірлерде анықталады, лайлы түйірлерде – фосфор мен магний, лайлы және ұсақ тозаң түйірінде – калий, магний. Жерді жырту кезінде иллювиалды деңгей бөлігін біртіндеп қосу табиғи құнарлы заттар қорын қалпына келтіру үшін қажет. Соңғысы өсімдіктер үшін ұсақ түйірлер мен құнарлану элементтерінің санын толтырады.

Кілтті сөздер: калий қоры, агро-сұр топырақтар.