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AGROCHEMICAL CHARACTERIZATION OF PODZOLIC-YELLOW SOILS FERTILIZED FOR A LONG TIME

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АГРОХИМИЧЕСКАЯ ХАРАКТЕРИСТИКА ДЛИТЕЛЬНО УДОБРЯЕМЫХ ПОДЗОЛИСТО-ЖЕЛТОЗЕМНЫХ ПОЧВ

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Abstract. It is known from our research that in the last 40-50 years, as a result of intensive use of podzol-yellow soils, the reserve and amount of humus reduced, mechanical composition relatively lightened, but relatively stabilization was observed in humus quantity in the areas where the crop rotation was available. It is known that among the agricultural plants, the standard soil for tea plant — weakly podzolic yellow soil has a score of 100 points on the quality scale. Every year application of mineral fertilizers is required in order to get a lot of green leaf crops from the tea plant bushes in terms of soil-ecological requirements. Therefore, physiological acid ammonium-sulfate fertilizer is applied to bushes at a high dose every year. The super-phosphate fertilizer with more gazh in its composition is applied together with nitrogen fertilizer in order to increase its efficiency. In addition to it, potassium-chlorine or potassium-sulfate is applied. According to the research results it can be noted that humus of moderately washed sort decreased 0,1-1,30%, total nitrogen — 0,07-0,08%, absorbed ammoniac — 20,60-40,14 mg/kg, ammoniac dissolved in water — 1,56-4,38 mg/kg, nitrate – 0,24-2,34 mg/kg, total phosphorus — 0,04-0,05%, gross phosphorus — 2,28-23,54 mg/kg, total potassium — 0,14-0,80 %, exchangeable potassium — 50,0-77,4 mg/kg compared to non-degraded sort.

Аннотация. В последние 40–50 лет в результате интенсивного использования подзолисто-желтоземных почв запасы и количество гумуса сокращаются, механический состав относительно облегчается. Но наблюдается относительная стабилизация количества гумуса в почвах территорий, где существовал севооборот. Среди сельскохозяйственных растений стандартная почва для чайного растения — слабоподзолистая желтая почва имеет оценку 100 баллов по шкале качества. Ежегодно необходимо внесение минеральных удобрений для получения большого количества зеленых листьев кустов чайного растения с точки зрения почвенно-экологических требований. Поэтому ежегодно вносят под кусты физиологическое кислое сульфатно-аммонийное удобрение в высокой дозе. Суперфосфатное удобрение с большим количеством гажа в составе вносится вместе с азотным удобрением для повышения его эффективности. Помимо него вносят калия хлорид или калия сульфат. По результатам исследований можно отметить, что гумус умеренно промытого сорта снизился на 0,1–1,30%, общий азот — 0,07–0,08%, поглощенный аммиак — 20,60–40,14 мг/кг, растворенный в воде аммиак — 1,56–4,38 мг/кг, нитраты — 0,24–2,34 мг/кг, фосфор общий —0,04–0,05%, фосфор валовой — 2,28–23,54 мг/кг, общий калий — 0,14–0,80%, обменный калий — 50,0–77,4 мг/кг по сравнению с неразложившимся сортом.

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Keywords: organic fertilizers, tea plant, acidity, podzolic-yellow soils.

Ключевые слова: чайное растение, кислотность, подзольно-желтые земли, органическое удобрение.

Application of physiological acid ammonium-sulfate, super-phosphate and potassium-chloride fertilizers for a long time affects agrochemical character of soil. As it is known, the experiments have been carried out in the podzol-yellow soils and their various sorts [9, 10].

Regularly application of organic-mineral fertilizers shows itself in its impact on agrochemical character of podzolic — yellow soils, firstly change of soil reaction. For example, application of ammonium-sulfate and superphosphate for a long time increases pH, hydrolytic and variable acidity in the soil. pH — 0,9-1,4 in water suspension and pH — 0,7-1,2 in salt suspension increases towards acidity [2, 3, 7].

While applying physiological acid fertilizer at a high dose, acidity of soil rises. For example, when physiological acid ammonium-sulfate fertilizer is given at the expense of 360 kg of nitrogen in the fruitful plantations of the Lankaran Tea branch pH — 1,2 rises to acidity, hydrolytic acidity increases 14,8 mg-eq per 100 gr of soil. An attitude of the agricultural plants including tea plant to reaction of the podzol — yellow soil (pH) solution is different. Reaction of the soil solution greatly influences the entry of nutrients into plants. As it is known, the soil solution is formed as a result of water current in soil and soil wetting, in the process of soil-formation where various salts and acids are dissolved in water. In other words, when the pure water soaks the soil, then affects its solid part, it absorbs the substances dissolved in it and as a result it turns into soil solution [4-6, 8].

The soil solution, i.e. liquid soil phase has a great importance for normal nourishment of plants by their root. It is a main and direct source of the nutrients for plants, because the plants assimilate more nutrients from soil solution. An important character of the soil solution is its reaction. These reactions are acid, neutral and alkaline solutions for their character. As the organic fertilizers are slowly decomposed (mineralization and ionizing) as a rule, it is good to apply them under the main plow (to the depth of 20-30 cm) in autumn with an interval of 3-4 years. We should note that the organic fertilizers in fresh condition, as soon as it is obtained, it must be stored in the closed containers or covertly (with soil, sand or polyethylene) in the shape of a hook (heap) until it is used. The fertilizer that is taken from hook or heap should be immediately sown on the field and mixed with the soil by deep plowing [9-11].

Material and methodology

A quantity of absorbed cations changes in soil as a result of application of the organic-mineral fertilizers for a long time. An amount of magnesium is more than calcium. As the dose of ammonium-sulfate applied to the soil increases, a quantity of absorbed calcium reduces, and magnesium rises in soil. As the high dose of super-phosphate applied, an amount of absorbed calcium predominates over magnesium in the podzolic-yellow soils. As a result of application of mineral fertilizers for a long time, not only ratios of calcium and magnesium change, but also a quantity of gross aluminum rises. A quantity of aluminum mostly rises in the areas where fertilizer is applied at a high dose [1, 2].

Application of mineral fertilizers for a long-time changes concentration of organic substances and nitrogen in the podzolic-yellow soils. The research show that application of mineral fertilizers for a long time accelerates biological and physical-chemical processes in soil, decomposition and mineralization of nitrogen combinations, biological and physical-chemical processes, and activates biological absorbing (https://kurl.ru/AxAyg).

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Table 1

EXPERIMENTAL AREA:
AGROCHEMICAL CHARACTER OF PODZOLIC-YELLOW SOILS UNDER THE TEA (2023)

Depth, cm	*Humus, %*	*Total nitrogen, %*	*Nitrogen*			*Phosphorus*		*Potassium*		*pH in water solution*	*pH-salt*
			Absorbed N/NH_3, mg/kg	*Dissolved in water N/NH_3, mg/kg*	*N/NO_3, mg/kg*	*Total phosphorus, %*	*Gross, mg/kg*	*Total, %*	*Exchangeable, mg/kg*		
Non-degraded soils											
0-30	2.6	0.14	61.1	12.3	5.1	0.15	93.6	2.29	172.0	5.3	3.9
30-60	2.1	0.12	52.1	11.6	3.3	0.14	40.5	2.18	146.0	5.2	3.9
60-100	1.1	0.09	31.2	5.2	1.5	0.10	24.3	2.48	112.0	4.9	4.2
Moderately degraded soils											
0-30	1.2	0.05	21.4	7.0	2.9	0.12	70.0	1.50	92.0	5.4	4.1
30-60	1.1	0.03	12.6	5.0	2.5	0.09	32.0	1.45	64.40	6.6	3.9
60-100	1.3	0.02	9.5	3.0	1.4	0.06	23.0	1.35	62.0	5.9	4.5

Table 2

EXPERIMENTAL AREA:
AGROCHEMICAL CHARACTER OF PODZOLIC-YELLOW SOILS UNDER THE TEA (2024)

Depth, cm	*Humus, %*	*Total nitrogen, %*	*Nitrogen*			*Phosphorus*		*Potassium*		*pH in water solution*	*pH-salt*
			Absorbed N/NH_3, mg/kg	*Dissolved in water N/NH_3, mg/kg*	*N/NO_3, mg/kg*	*Total phosphorus, %*	*Gross, mg/kg*	*Total, %*	*Exchangeable, mg/kg*		
Non-degraded soils											
0-30	2.7	0.12	62.0	12.3	5.0	0.15	95.09	2.30	172.0	5.6	4.3
30-60	2.4	0.10	51.0	10.2	3.0	0.15	42.40	2.10	147.0	5.1	3.9
60-100	1.3	0.09	30.0	6.4	1.0	0.11	22.30	2.30	113.0	5.4	4.4
Moderately degraded soils											
0-30	1.4	0.05	22.0	7.5	3.50	0.11	71.4	1.56	94.5	5.3	4.3
30-60	1.1	0.03	11.0	7.0	3.20	0.09	33.0	1.47	66.3	6.1	4.1
60-100	1.3	0.02	10.0	4.3	2.10	0.07	22.0	2.35	61.0	6.0	4.6

So, application of mineral fertilizers at an optimal norm for a long time affects the transition of nutrients from one form to another, their movement in soil. For example, humus was 2,0% in soil taken from a non-fertilized field, but it was 2,88% in the areas where fertilizer is applied. There is a great importance of fertilizers in improvement of agrochemical characters of podzolic-yellow soils under the tea. Considering this, a quantity of total and assimilated forms of nutrients was defined in the taken soil samples. A quantity of total humus vibrates by 1,60-2,80 % in one-meter layer of soil in non-degraded soils under the tea in the samples taken to study the agrochemical characters of the soil in 2023-2024 (average of 2 years). Total nitrogen concerning the potential fertility in these soils over profile was 0,13-0,16%, total phosphorus — 0,12-0,18%, potassium — 2,64-2,50%. Ammoniac dissolved in water in 1 kg of soil changes by 5,9-13,0, absorbed ammoniac — 32,28-64,0, nitrate nitrogen — 1,94-6,24, gross phosphorus — 26,68-96,54, exchangeable potassium — 116,20-174,80 mg/kg (Table 1).

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Table 3

EXPERIMENTAL AREA: AGROCHEMICAL CHARACTER OF PODZOLIC-YELLOW SOILS UNDER THE TEA (2023-2024-average of 2 years)

Depth, cm	*Humus, %*	*Total nitrogen, %*	*Nitrogen*			*Phosphorus*		*Potassium*		*pH in water solution*	*pH-salt*
			Absorbed N/NH_3 mg/kg	*Dissolved in water N/NH_3, mg/kg*	*N/NO_3, mg/kg*	*Total phosphorus, %*	*Gross, mg/kg*	*Total, %*	*Exchangeable, mg/kg*		
Non-degraded soils											
0-30	2.6	0.15	63.0	13.2	6.14	0.17	95.54	2.51	173.8	5.0	4.1
30-60	2.4	0.13	54.12	10.3	4.29	0.16	43.58	2.44	150.1	5.2	4.0
60-100	1.4	0.11	32.24	5.7	1.84	0.11	26.57	2.65	115.2	5.4	4.4
Moderately degraded soils											
0-30	1.4	0.07	23.78	8.72	3.80	0.12	72.0	1.70	96.40	5.4	4.2
30-60	1.3	0.06	14.26	7.04	2.80	0.11	33.8	1.80	78.50	6.6	4.0
60-100	1.4	0.05	11.57	4.24	1.60	0.06	23.3	2.40	65.2	5.8	4.5

Results

The degradation process negatively affects agrochemical indicators of podzolic-yellow soils under the tea and decreased their quantity. So, humus was 0,1-1,30% , total nitrogen — 0,07-0,08%, absorbing ammoniac — 20,60-40,14 mg/kg, ammoniac dissolved in water was 1,56-4,38 mg/kg, nitrate — 0,24-2,34 mg/kg, total phosphorus — 0,04-0,05%, gross phosphorus — 2,28-23,54 mg/kg, total potassium — 0,14-0,80%, exchangeable potassium 50,0-77,4 mg/kg in moderately washed kind of soil compared to non-degraded kind of soil (Table 2, 3). A quantity of pH was 0,4-0,3 in water solution, but it was 0,2-0,1 in salt suspension. That is, it was determined that the soil environment changed from acidity to alkaline environment.

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