AGROCHEMICAL AND BIOLOGICAL PROPERTIES OF IRRIGATED GRAY SOILS

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https://doi.org/10.5281/zenodo.7907841

Abstract: The article provides information about the agrochemical properties and biological activity of typical irrigated serozem soils. The study of soil properties and biological activity is of great importance in increasing the fertility of typical irrigated serozem soils.

Key words: soil fertility, enzyme, protease, urease, soil erosion.

Аннотация: Ушбу мақолада суғориладиган типик бўз тупроқларнинг агрокимёвий хоссалари ва биологик фаоллиги бўйича маълумотлар келтирилган. Суғориладиган типик бўз тупроқларнинг унумдорлигини оширишда тупроқнинг хоссаларини ва биологик фаоллигини ўрганиш муҳим аҳамиятга эга.

Калит сўзлар: тупроқ унумдорлиги, фермент, протеаза, уреаза, тупроқ эрозияси.

Аннотация. В статье приведены сведения об агрохимических свойствах и биологической активности типичных орошаемых сероземов. Изучение свойств почв и биологической активности имеет важное значение в повышении плодородия типичных орошаемых сероземов.

Ключевые слова: плодородия почв, фермент, протеаза, уреаза, эрозия почвы.

Introduction. Continuous biological processes in the soil play an important role in increasing soil fertility. Biological substances in the soil indicate the occurrence of various processes. For obtaining fertile soil, firstly, it is necessary to study its properties, composition, and the various biological activities that take place in the soil.

Typical serozem soils are eroded to varying degrees. Erosion damages the fertile layer on the surface of soil and also washes away the topsoil. As a result, it reduces soil fertility. The fertile layer on the surface of eroded soils is washed away to varying degrees. Under the influence of the erosion process, the amount of humus and nutrients in the soil decreases sharply. Erosion processes adversely affect the physical, mechanical, chemical, agrochemical properties, biological activity and biochemical properties of the soil leading to a decrease in soil fertility. It is necessary to develop anti-erosion measures to reduce erosion processes in the soil and prevent erosion. Protecting the soil from erosion will yield results if the measures developed are followed. It is expedient to maintain and increase the amount of humus and nutrients in soil for soil fertility.

Enzymes play an important role in the conversion, decomposition, and formation of humic substances of soil organic substances. The main sources of enzymes are living organisms living in the soil, bacteria, actinomycetes and plant debris. Enzymes in the soil are actively involved in the conversion of organic residues. All enzyme complexes in the soil determine the enzymatic activity of the soil. The activity of enzymes in the course of biochemical processes in the soil is much higher in the surface layers of the soil.

Decomposition and complex transformation of various chemical compounds occur in the soil. Proteins in microorganisms and plants are broken down into amino acids in the presence of protease enzymes. In soil biological activity, enzymes are involved in the formation of nitrogen in redox reactions, nitrogen metabolism, and the formation of proteins. Enzymes, which are the basis of biological activity, are actively involved in the transformation and decomposition of organic matter, and in the formation of humic substances. Enzymes give high results even in very small amounts. Enzymes accelerate biological activity in the soil. The enzyme urease in the soil is involved in the ammonification of urea and the conversion of nitrogen to a form that plants can assimilate. The protease enzyme in the soil is involved in the formation of nitrogen in the soil and nitrogen metabolism.

The biological activity of the soil is directly related to the organic matter in the soil. In soils with a lot of humus, the species of microorganisms are extremely diverse and abundant, and the biological activity in these soils is also high. This in turn enhances the process of photosynthesis. If there is high biological activity in the soil, there will be favorable conditions for high yields of agricultural crops. Decreasing the amount of humus in the soil leads to a decrease in the biological activity of the soil and reduces soil fertility. Continuous biological activity and biochemical processes in the soil play an important role in increasing soil fertility. Different biologically active substances in the soil indicate the occurrence of various biochemical processes in it. The study of their properties allows us to better understand the activity of microorganisms in the soil, their role in increasing soil fertility. Enzymatic activity is a sensitive indicator of the biological condition of the soil. It was observed that the activity of urease enzyme in the soil is very low in the tillage layer of the soil, in spring than in autumn, the activity of urease enzyme in non-eroded soils is higher than in eroded soils. The erosion process negatively affects the activity of the urease enzyme, reducing the biological and biochemical properties of the soil.

Enzymes in the soil play a special role in the acceleration of biological and biochemical processes in the organic complex of the soil. The activity of enzymes and the formation and amount of protein substances that are the product of biochemical processes in the soil are of particular importance in increasing soil fertility. In the course of various biochemical reactions in a particular soil, in the decomposition of organic matter, in the formation of nitrogen by enzymes in the soil that plants can assimilate, in the decomposition of organic matter into humus and proteins, the more intensive the biochemical processes, the greater the fertility of the soil.

Aims and objectives of the work consist of studying the morphological characteristics, physical and agrochemical properties of typical irrigated serozem soils, the role of urease and protease enzymes in the biological activity of soil.

Object of research: the soils studied in the area of the Extension center of Tashkent State Agrarian University, the properties and biological activity of the soils have been studied, typical irrigated serozem soils in this area are weak and moderately eroded, the mechanical composition of which is medium sandy soils.

Geographical location and climate of the region. Experimental area (Extension center) of Tashkent State Agrarian University. Typical irrigated serozem soils, uneven relief.

Climate: Subtropical, annual rainfall is around 399-422 mm, with heavy rainfall in autumn, winter and early spring. The vegetation period for plants is 204-234 days. The temperature is

+ 39.7 + 45.8 ^{0}C in July, and -11.3-11.7 ^{0}C in January. The sum of the efficiency is 2220-2450^0 C.

The results of research: Morphological features of typical serozem soils. The origin and properties of serozem soils are associated with modern factors and processes, with special emphasis on specific hydrothermal regimes that determine the intensity and rhythm of biological and biochemical processes in serozem soils. Serozem soils have a unique structure, the color of which is lighter and does not differ much from the color of the parent rock, as the amount of humus is less in the upper part of the soil section. In typical irrigated serozem soils, the main section is excavated from the layer of soil and the morphological features of the soil have been studied. Typical irrigated serozem soils that are not eroded are serozem in color, the thickness of the humus layer ($A+B_1+B_2$) is 65 sm, the mechanical composition is mainly medium sandy soil, the CO_2 carbonate layer starts from 30 sm. The color of typical eroded serozem soils is serozemish-yellow, the thickness of the humus layer is 42 sm. CO_2 carbonate layer starts from 20 sm. The color of typical serozem soils collected under the influence of erosion is dark serozem, the thickness of the humus layer is 71 sm, CO_2 carbonate layer starts from 32 sm, the mechanical composition consists of medium sandy soils [7; 9; 10].

Mechanical composition and physical properties. The study of the mechanical composition of the soil is important in increasing soil fertility. The study of the mechanical composition and physical properties of the soil is a key indicator in the assessment of soils, the application of agro-technical and reclamation measures to increase soil fertility. The mechanical composition of the soil varies depending on the slopes where the soil is distributed, the degree of erosion and the parent rock of the soil. The soils of the lands on the slopes have a high level of washing off under the influence of erosion, the amount of physical clay in the upper layer of the slope is low, and the amount of physical clay in the areas washed away by the erosion process is high. In the plains, the washing away power of water in the soil is low, and the non-eroded soils have the same constant mechanical composition.

The mechanical composition of typical irrigated serozem soils consists of medium and heavy sand. The mechanical composition of typical irrigated serozem soils is medium sand in the upper plowing (tillage) layers, the mechanical content in the lower layers of the soil cross section is heavier, the amount of coarse dust (0.05-0.01mm) is 29.9 -36.2%, medium and fine dust (0.01-0.001mm) ranges from 27.4 -33.1 to 41.4%. The amount of fine sand (0.1-0.05mm) reaches 5.7-16.1%. The amount of clay (less than 0.001mm) can range from 12.7 to 17.8.

In typical irrigated serozem soils, the amount of physical clay is 43.3% in the upper plowing layers of the section of soil and 46.5% under the plowing layer. In typical irrigated serozem soils, it was observed that the mechanical content gradually increased in the lower layers of the soil cross-section and shifted from medium sand to heavy sand.

The specific gravity of typical irrigated serozem soils ranges from 2.68 to 2.69 g/sm^3, with the lowest specific gravity occurring in the humus layer of the soil. The specific gravity increases towards the lower layers of the soil. The volume weight of typical irrigated serozem soils is 1.34 -1.37 g/sm^3 in the topsoil and 1.37-1.48 g/sm^3 in the lower layers. The porosity of typical irrigated serozem soils was observed to be around 49.07-50.18%.

The specific gravity of typical eroded irrigated serozem soils ranges from 2.66 to 2.67 g/sm^3, with the lowest specific gravity occurring in the humus layer of the soil. The volumetric weight of typical irrigated eroded serozem soils is 1.32-1.33 g/sm^3 in the topsoil and 1.39-

1.46 g/sm^3 in the lower layers. The porosity of typical irrigated serozem soils was observed to be around 47.94-50.37 %.

Agrochemical properties of typical irrigated serozem soils. In typical irrigated serozem soils, the humus content is 1.73-1.89 % in the topsoil and 0.65-1.60 % below the topsoil, while in the lower layers of the soil profile this figure decreases. In typical irrigated serozem soils, the total nitrogen content in the topsoil is 0.150-0.160 %, the phosphorus content is 0.160-0.170%, and the potassium content is 1.80-1.90%. The amount of mobile phosphorus reaches 16.0-20.0 mg/kg, mobile potassium reaches 120-140 and sometimes 190 mg/kg in the typical irrigated serozem soils studied.

In typical irrigated serozem soils, the amount of humus and nutrients decreases sharply in the soil layers towards the lower layers. The content of CO_2 carbonates in these soils ranges from 7.35 to 8.40%, while in the lower layers this figure ranges from 7.48 to 8.54%. The pH of the soil medium reaches 7.10-7.40.

In typical non-eroded irrigated serozem soils, the humus content is 1.73-1.89%, the total nitrogen content is 0.150-0.160%, the phosphorus content is 0.160-0.170%, and the potassium content is 1.80-1.90%. The amount of humus in eroded soils is 1.03-1.38%, nitrogen is 0.070-0.080, phosphorus is 0.134-0.142, potassium is 1.70-1.80%. Humus content in soils accumulated under erosion was found to be 1.72-1.91%, nitrogen 0.158-0.182, phosphorus 0.160-0.180, and potassium 1.80-2.00%

Biological acitivity of typical irrigated serozem soils. The study of soil biological activity is important in maintaining and increasing soil fertility. The biological activity of the soil depends on the action of biologically active substances - enzymes, redox reactions, the amount of microorganisms and the intensity of biochemical processes, which are broken down in the soil as a result of decay of plant residues. Enzymes play a special role in determining the basis of biological activity in the soil in the acceleration of biological and biochemical processes in the organic complex of the soil. Enzymes that show biological activity in the soil, the formation and amount of free amino acids in the soil are of particular importance in increasing soil fertility. In the course of various biochemical reactions in the soil, in the decomposition of organic matter, in the formation of nitrogen that can be assimilated by plants in the soil, in the decomposition of organic matter into humus and protein, the more biochemical processes the more fertile substances are formed in the soil. Continuous biological and biochemical processes in the soil play an important role in increasing soil fertility.

Various enzymes in the soil are actively involved in oxidation-reduction reactions, nitrogen formation, nitrogen metabolism and protein formation. Enzymes in the soil are biological catalysts that are actively involved in the conversion and decomposition of organic matter, and the formation of humus. Gives high efficiency even in very small amounts, accelerates biological activity in the soil, accelerates chemical reactions in microorganisms.

The urease enzyme in the soil is involved in the ammonification of urea and the conversion of nitrogen to a form that plants can assimilate. The enzyme protease in the soil is actively involved in the formation of nitrogen in the soil, nitrogen metabolism, the formation and breakdown of proteins in the soil, breaking down proteins into amino acids. The enzyme urease is active in the formation of nitrogen in the soil, the formation of organic matter and nucleic acid, the hydrolysis of urea and the transition to a form of nitrogen that can be assimilated by plants.

Protease enzyme is an enzyme required for the formation of nitrogen in the soil, an enzyme involved in the formation of proteins, the formation and breakdown of free amino acids, and also protease enzyme plays an important role in the transformation and decomposition of organic matter and in the formation of humus [1; 6].

The uptake of urea and the conversion of nitrogen to a form that plants can assimilate depends on the activity of the enzyme urease in soils. The enzyme urease is mainly produced by a group of urobacteria in the soil, this enzyme found in fungal putrefactive bacteria and azotabacteria.

To increase the activity of protease enzymes in soils, it is necessary to increase their content in the soil by accelerating the accumulation of organic matter in the soil and biological activity in the soil. As the organic matter in the soil increases, the biological and biochemical processes of the soil intensify. Plant residues and organic fertilizers in the soil, biohumus accelerates the activity of microorganisms, bacteria and fungi in the soil, leading to improved biological and biochemical processes in the soil [9, 10].

The dependence of enzymes improvement on the soil surface vegetation, humus content, soil mechanical composition, soil environment, soil biogenicity and biological activity has been studied and substantiated. It has been found that the activity of urease and protease enzymes in typical irrigated serozem soils varies in different seasons [9, 10].

The activity of urease and protease enzymes in typical irrigated serozem soils varies in autumn and spring, the negative impact of erosion on them, the effective impact of enzymes on mineral fertilizers, organic fertilizers and micro-fertilizers, the amount of urease and protease enzymes in the soil, mechanical composition of soil, nutrient elements and correlation with free amino acids in the soil were studied thoroughly [9].

The activity of urease and protease enzymes in typical irrigated serozem soils, the amount of enzymes in spring and autumn were analyzed. Seasonal dynamics of enzyme activity in the soil is determined by environmental factors, humidity and temperature. Hydrothermal conditions It was observed that urease enzyme from hydrolytic enzymes is high in spring and autumn [9; 10].

In the analyzed soils, the activity of the urease enzyme is significantly reduced in winter and summer. In typical irrigated serozem soils, the enzyme urease is mainly found in greater amounts in the topsoil layers of the soil. It is almost absent in the lower layers of the soil. The activity of the urease enzyme decreases sharply in the layers after 50 sm of soil layers. The distribution of the urease enzyme across soil layers also depends on how the process of soil formation takes place and the nature of the different soils.

The effect of erosion processes on the activity of the urease enzyme has also been studied, as a result of the erosion effect on the urease enzyme, the enzymes are reduced or washed away in the surface layers of the soil. In non-eroded soils, the urease enzyme is higher than in eroded soils. In maintaining and increasing soil fertility, the biological and biochemical properties of soil, the vital activity of microorganisms in the soil depend on the movement of biologically active substances in the soil formed after the decomposition of organic matter as a result of plant decay. The active participation of enzymes in the organic complex of the soil plays a particularly important role. Enzymes are a source of nitrogenous nutrients in increasing soil fertility.

It was observed that in non-eroded soils there is higher enzyme activity than in eroded soils. In typical irrigated serozem soils, the activity of urease and protease enzymes is high in

soil layers of 0-50 sm, low in layers of 50-70 sm, enzyme activity is very weak in layers 70-100 sm and below, and even enzyme activity is not noticeable there. In the layers following the 0-50 sm of soil cross-section, the biological activity of the soil decreases sharply. This has been observed to occur very sharply, especially in eroded soils. The activity of urease and protease enzymes in typical irrigated serozem soils varies from spring to autumn. It was observed that enzyme activity was higher in spring than in autumn. The activity of enzymes in the soil depends on the amount of humus in the soil, the thickness of the humus layer, the amount of nutrients, the pH of the soil environment, the physical, mechanical and chemical properties of the soil. The higher the activity of enzymes, the more better soil oxidation-reduction reactions, air exchange in the soil, it is also actively involved in nitrogen and phosphorus metabolism in the soil, proteins, as well as the formation of enzymes in the soil, and increases soil fertility. Enzymes accelerate biochemical reactions in microorganisms. Microorganisms, on the other hand, break down plant residues into organic matter, decomposing into the nutrients needed by plants. Biological activity in the soil is interrelated with microorganisms. In typical irrigated serozem soils, the biological activity is high in the plowing layers, the biological activity under the plowed layer of the soil slows down, and the biological activity in the lower layers of the soil after 50 sm decreases sharply and is not almost noticeable. The biological activity of typical irrigated serozem soils is more in spring and less in autumn, and the activity is almost imperceptible in summer and winter. This depends on the amount of humus in the soil and the activity of enzymes. Biological activity in the soil plays an important role in increasing soil fertility. The activity of enzymes in soils varies in typical irrigated serozem soils, and their activity and composition, more or less in the soil, depends on soil properties, plant type and seasons. The biological activity of the soil depends on the amount of humus in the soil, microorganisms in the soil and the properties of the soil too [9; 10; 11; 12].

The effect of erosion on urease and protease enzymes in typical irrigated serozem soils, the effect of different crop types, mineral, organic and micro fertilizers, were found to vary in different extent depending on the season.

Studies have shown that the activity of urease enzymes in typical irrigated serozem soils varies in autumn and spring. The effects of erosion, the effect of organic and micro-fertilizers, the amount of urease enzyme in different amount in different plant areas, correlation between urease enzyme and humus, soil mechanical composition, nutrients and free amino acids in soil have been studied. The enzyme urease has been studied to form as a result of plant decay [9,10].

The studied soils are typical irrigated serozem soils distributed in the experimental area (Extencion center) of the Tashkent State Agrarian University and the activity of protease and urease enzymes in spring and autumn was also studied.

The intensity of biological activity in the soil is determined by the seasonal dynamics of enzyme activity, environmental factors, humidity and temperature. It was observed that urease enzyme from hydrolytic enzymes is high in spring and autumn. The biological activity in maintaining and increasing soil fertility depends on the vital activity of microorganisms in it, the movement of biologically active substances in the soil, which break down organic matter as a result of plant decay. The active participation of enzymes in the soil complex plays a particularly important role. Enzymes are a source of nitrogenous nutrients in increasing soil

fertility. In the studied soils, urease enzyme activity is significantly reduced in winter and summer.

In typical serozem soils, the activity of urease and protease enzymes is high in soil layers of 0-50 sm, low in layers of 50-70 sm, enzyme activity is very weak in layers of 70-100 sm and below, and even not noticeable. In the layers following the 0-50 sm layers of soil cross-section, the biological activity of the soil decreases sharply. This has been observed to occur very sharply, especially in eroded soils. In typical serozem soils, the activity of urease and protease enzymes varies from season to spring and autumn. Enzyme activity is found to be higher in spring than in autumn. The activity of enzymes in the soil depends on the amount of humus in the soil, the thickness of the humus layer, the amount of nutrients, the pH of the soil environment, the physical, mechanical and chemical properties of the soil. The activity of enzymes in the soil is closely related to soil humus, microorganisms and soil properties, and the more organic matter residue and microorganisms in the soil, the higher the enzyme activity.

As a result of erosion, the activity of enzymes in the soil slows down. In typical serozem soils, the biological activity is high in the tillage layers, the biological activity is very high up to 50-70 sm of the soil cross-section, and it is sharply reduced and almost not observed in the layers below from 70 sm layer of soil.

Accelerating the biochemical process by increasing the biological activity in the soil is of great importance in increasing soil fertility. The enzyme urease in the soil is active in the formation of nitrogen in the soil, the formation of organic matter and nucleic acid, the hydrolysis of urea and the transition to a form of nitrogen that can be assimilated by plants.

The activity of the urease enzyme in the upper layers of irrigated, non-eroded typical serozem soils is 2.16 to 4.08 mg in spring in the topsoil or tillage layer, 1.98-3.54 mg in autumn, and sharply decreases to 0.58-0.36 mg in the lower layers of the soil. In the layers below 100 sm, urease enzyme activity is very low 0.08 mg in 24 hours in 1g soil, urease enzyme activity is very active in 0-30 sm layers of soil, it is moderate in 30-70 sm layers, and very low in lower layers, sometimes rare.

The activity of the urease enzyme in typical irrigated serozem soils was significantly lower in moderately eroded soils than in non-eroded soils, and the enzyme activity was found to decrease under the influence of the erosion process.

In typical serozem soils with moderate erosion, the activity of the urease enzyme is significantly reduced in spring, from 1.88 to 2.60 mg in the topsoil, 0.30-0.42 mg in the lower layer, and 0.08-0.16 mg in the layer lower from 100 sm. The indicators were known to be much lower in autumn than in spring. It was observed that the activity of the urease enzyme was 1.00-2.08 mg in the plowing layer; 0.20-0.36 mg in the lower layer; 0.02-0.04 mg in 100 sm layer.

In typical irrigated serozem soils washed away by erosion and cumulated, the enzyme urease was noted to be 2.96-4.34 mg in the surface layer of the soil in spring and 2.14-3.80 mg in autumn, in the lower layers 0.10-0.26 mg (24 hours in 1 g of soil). In typical irrigated serozem soils, the enzyme urease is mainly found in greater amounts in the upper tillage layers of the soil. The urease enzyme is almost absent in the lower layers of the soil. The urease enzyme decreases sharply in the layers from 50 sm bottom of the soil layer. Enzyme activity in non-eroded soils was observed to be higher than in eroded soils. The activity of urease enzyme in the soil is very low in the tillage layer of the soil in spring than in autumn,

the activity of urease enzyme in non-eroded soils is higher than in eroded soils. The erosion process negatively affects the urease enzyme activity, reducing the biological activity of the soil

The better the biological activity in the soil, the better the accumulation of nitrogen in the soil, and the soil becomes richer in nitrogenous nutrients. Protease enzyme activity in typical irrigated serozem soils was noted to be 0.088-0.136 mg in spring in the topsoil, 0.054-0.060 mg under the topsoil in non-eroded soils, while in autumn it is 0.078-0.112 mg in the topsoil, and 0.036-0.042 mg below topsoil per 1 g of soil, in eroded soils this indicator decreases sharply, in moderately eroded soils the activity of protease enzyme was 0.062-0.102 mg in the tillage layers of the soil in spring and 0.056-0.092 mg in autumn, and very low in the lower layers. It was found to be 0.022-0.030 mg per 1g of soil in 24 hours, 0.102-0.166 mg in surface layers in irrigated typical serozem soils washed away by erosion and cumulated in the spring and 0.094-0.132 mg in autumn. In the lower and bottom layers of the soil, it ranged from 0.060-0.086 mg to 0.014-0.030 mg, in autumn this indicator was analyzed to be 0.014-0.026 mg (1 gram in 24 hours in the soil) Enzymes in the soil play a special role in the acceleration of biological and biochemical processes in the organic complex of the soil. The activity of enzymes, the formation and amount of proteins in the soil, that is, free amino acids are of particular importance in increasing soil fertility. In the course of various biochemical reactions in the soil, in the decomposition of organic matter in the soil to form nitrogen that can be assimilated by plants by enzymes, in the decomposition of organic matter in the formation of humus and protein, the more intensive the biochemical processes, the more substances are formed in the soil that affect fertility. Enzyme activity is an active, sensitive indicator of the biological properties of the soil. Enzymes control the intensity and direction of biological and biochemical processes in the soil, the course and speed of the reaction, oxidation-decomposition reactions, and the formation of substances.

The intensity and amount of biological activity in typical irrigated serozem soils vary depending on seasons, that is, different in spring and autumn, when mineral and organic fertilizers and micronutrient microfertilizers are sown in different crops, and also biological activity is interrelated with soil humus content, soil mechanical composition and its physical properties. Enzyme activity in soils varies in amount in typical irrigated serozem soils, and its amount in the soil depends on soil properties, plant type, and seasons [10].

Conclusion. 1. Typical serozem soils in the region of serozem soils are distributed in the foothills, plain slopes, mountain range, in the higher parts of the lower mountains. The climate of the region of serozem soils is sharply changing, subtropical continental.

2. The relief of typical serozem soils is uneven, with curved slopes. Eroded to varying degrees. The process of erosion has a negative impact on the physical and mechanical composition, agrochemical and biological activity of soils.

3. Biological activity in typical serozem soils is high in layers 0-50 sm of soil, low in layers 50-70 sm, biological activity decreases in layers 70-100 sm and below, and biological activity of soil decreases sharply in lowers from 0-50 sm layers of cross-section of the soil. This has been observed to occur very sharply, especially in eroded soils.

4. Biological activity differs from season to season, biological activity is higher in spring than in autumn, more in spring and less in autumn. It is too low in summer, and not noticeable in winter

5. Biological activity in the soil depends on the amount of humus in the soil, the thickness of the humus layer, the soil environment and the properties of the soil.
6. The activity of enzymes in the soil depends on the vegetation cover of the soil, climatic conditions, soil formation processes, morphological, physical-mechanical, chemical properties of the soil.

References:

1. Abdujalalova.M.U. Enzymes in some desert soils of southern Uzbekistan. Tashkent. 1976.
2. Agafarova. Ya.M. Biochemical aspects and biology of farming. Book. Ecology and protection of soils in arid territories of Kazakhstan. Alma-Ata. 1991.
3. Gafurova. L.A, Makhsudov.Khn.M, Adel M.Yu. Biological activity of eroded Neogene residues. “Uzbekistan” Tashkent.1995.
4. Galstyan A.Sh. Method for determining the activity of soil hydrolytic enzymes. "Soil Science", 1965, No. 2, pp. 219-222.
5. Kuprevich.V.F, Sherbakova T.A.Soil enzymology. Minsk.1966.
6. Peyve Ya.V. Biochemistry of soil. M., 1961, pp.97-196, pp.313-396
7. Raimbaeva. G.Sh. Free amino acids in eroded typical serozem soils of the Chirchik-Keles interfluve. Cand. diss.. Tashkent. 2000.
8. Raimbaeva. G.Sh. Free amino acids in eroded typical serozem soils of the Chirchik-Keles interfluve. Monograph. Tashkent. 2001
9. Raimbaeva.G.Sh. Microelements and enzymes in eroded serozem soils of the Tashkent oasis. Tashkent. 2012.
10.Raimbaeva.G.Sh. Elements of fertility and biochemical processes in typical serozem soils. Monograph. Tashkent 2020.
11. Raimbaeva G.SH., Mirkhaydarova G.S.. Properties and biological activity of rainfed serozem soils formed in neogenic slopes in Uzbekistan. E3S.Web of Conferences 284, 02007 (2021) TPACEE–2021.1-8pp. Scopus. https://doi.org/10.1051/e3sconf/202128402007 8.
12. Raimbaeva G., Ismailov D.. Morphological structure and mechanical composition of typical serozem soils. International conference of science and education. Science and education. Antalya, Turkey. May 15. 2021. 11–13pp. Scopus.
13. Khaziev F.Kh, Agafarova Ya.M. Proteolytic activity of western black soils of Cis-Urals. Biol. Sciences. No. 5 1975. pp.130-135.
14. Khaziev F.Kh. Enzymatic activity of soils. M., 1976, pp.23-41..