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Research Article

Energy Features Amino Acids in Irrigated Soils

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Abstract

The paper studies the potential energy in virgin and irrigated light gray soils in the north of Fergana through the energy of some amino acids. Each amino acid separately contains a certain share of energy, which distinguishes them from each other and affects the properties of the soil in different ways.

Irrigation of soils causes the need to study humus formation processes for forecasting and regulating the state of the organic part of soils. Numerous studies of soils in Central Asia, including Uzbekistan, have revealed that the indicators of humification processes differ by soil-climatic zones and types, soil subtypes, and their state is affected by various types of anthropogenic impact, including irrigation.

The process of humification and mineralization constantly occurs in soils. The process of formation and mineralization of humus is enhanced, where proteins, amino acids, and other nitrogen-containing substances are formed as an intermediate product, which significantly improves plant nutrition.

The organic matter of sierozem soils contains free and protein amino acids, which play an important role in the process of sierozem formation [1,2]. They occupy a special place among the many diverse soil substances that make up the group of non-specific compounds and are also part of humus.

For different groups of organisms, the number of essential amino acids is different. All proteins synthesized by the body accumulate in cells from 20 basic amino acids, only some of them can be synthesized by the body. The inability to synthesize a certain protein by the body leads to a violation of the normal functioning of the metabolism, so it is necessary to supply essential amino acids to the body.

Despite the small content of organic nitrogen, important amino acids with high biogeochemical activity are of great importance for the nutrition of agricultural plants.

The study of the theoretical foundations for improving soil-ecological and energy conditions and increasing the fertility of neutral slightly alkaline sierozem soils, taking into account the evolution of virgin and irrigated soils, is one of the most pressing problems.

Important indicators that determine the level of potential soil fertility, along with others, are the humus and energy state of the soil, the content, and composition, as well as the energy characteristics of soil-free essential amino acids.

The object of the research is virgin and irrigated light gray soils in the north of the Fergana Valley within the Namangan region. Virgin and irrigated light gray soils are taken as an object, reference cuts are set on these massifs and according to the field research methodology, 4 sometimes more half-pits and ditches are taken around each reference cut.

Field and laboratory studies of soils were conducted based on the morphogenetic method of V.V. Dokuchaev and the landscape-geochemical method of B.B. Polynov, M.A. Glazovskaya, and A.N. Perelman. Agrochemical and agrophysical analyses of soils were conducted according to the methodology given in the manual and "Methods of agrochemical, agrophysical and microbiological studies in irrigated cotton regions."

The determination of amino acid content and their identification were performed by liquid chromatography using a liquid chromatograph operating in protein hydrolysate analysis mode.

The issues of agrophysical, agrochemical, energy, and other properties of soils in the Fergana Valley have been

Table 1: Changes in the energy content of essential amino acids, mlcal/g.

Depth, cm	Valin	Treo - nin	Trip - tofan	Meti - onin	Phenyl - alanine	Lysine	Lei - qing	Isolei - cin
Light serosomes, pure 5x								
0-5	3.97	49.4	35.7	8.25	22.8	7.42	1.01	1.78
5-22	2.23	28.0	12.1	0	9.92	5.23	0	1.47
22-43	1.77	6.76	0	0	1.03	5.36	0	0
43-89	0.68	3.83	1.38	0	1.11	2.52	0	0
Light gray soils, irrigated 6x								
0-36	5.72	50.5	9.77	2.01	7.98	6.34	2.02	1.73
36-42	0	29.4	5.31	0	3.41	4.17	0	0,77
42-86	0,52	19,1	5,42	3,22	1,43	3,71	1,65	2,24
86-113	0,46	16,5	0	0	1,19	2,85	0	1,98

studied by many authors [3-7]. Some authors have studied the quantitative and qualitative composition of free amino acids in soils formed on Neogene and loess deposits, and have identified the influence of erosion processes and anthropogenic factors on them.

Quantitative and qualitative changes occur in the biological cycle depending on the influence of natural and anthropogenic factors, as well as in connection with parent rocks.

As for the role of essential amino acids in soils and plants, the material is very scarce, but there is data on the Internet "Amino acids for crop nutrition", which indicates that amino acids for plants are essential building blocks in the construction of proteins.

Amino acids can be an additional source of organic nitrogen, especially in natural conditions. Root secretions of plants are also an important source of free amino acids in the soil. The functions of amino acids are multifaceted and at the same time individual and they participate in many soil and plant processes. Stress factors, depending on the indicator, can have different causes and affect plants in a certain period. Stress factors caused by can last for a long time, in most cases hurting the quality and quantity of the harvest. Diseases, pests, and weeds can lead to a significant decrease in the yield of crops.

The content of potential energy of free essential amino acids in the future in the assessment of the fertility of irrigated soils, the development of the calculation of the elemental composition and their potential energy, which are spent in the soil-forming process as a result of the biogeochemical cycle of mass and energy, is of great scientific and practical importance. The energy approach to the characteristics of free soil essential amino acids allows us to quantitatively and qualitatively determine the potential energy value of free soil amino acids, as well as predict the processes of decarbonization and restoration of soil fertility.

From the results of the analysis presented in Table 1, it is evident that in terms of the energy content of valine, threonine, and tryptophan, as well as the sum of amino acids, irrigated light gray soils differ significantly from their virgin analogs.

Thus, the potential energy of threonine, which regulates the work of leaf stomata under unfavorable weather conditions in sod horizons, is 49.4 - 3.83 mlcal/g, respectively, and in irrigated horizons it is 50.5 - 16.5 mlcal/g.

In general, in the soils indicated, changes in the content of potential energy of the studied amino acids are practically proportional to their content in the soil. In addition, they are associated with the humus content of the soils.

The total potential energy of soil essential amino acids is practically many times higher in virgin dark sierozems in relation to their irrigated analogues, which indicates a higher potential fertility of virgin soils, and the absence of such important amino acids as histidine in soils can lead to disruption of the absorption of nutrients , metabolic processes, ripening of fruits, balance of water exchange processes, deterioration of the work of leaf stomata of plants resist various natural and anthropogenic stresses. Considering the above, various amino complexes can be used in agriculture, taking into account the soil and climatic properties of the region and growing the most crops.

References

1. Yuldashev G, Khaydarov M. Amino acid pool of serozem in the north of Fergana. Namangan State Univ J. 2019;(8):86–92. Available from: https://namdu.researchcommons.org/cgi/viewcontent.cgi?article=1664&context=journal
2. Yuldashev G, Khaydarov M. Energy potential of humus in gray soils. Namangan State Univ J. 2019;(11):62–67. Available from: https://namdu.researchcommons.org/cgi/viewcontent.cgi?article=1855&context=journal
3. Turdaliev A, Yuldashev G, Askarov K, Abakumov E. Chemical and biogeochemical features of desert soils of the Central Fergana. Agriculture (Pol'nohospodárstvo). 2021;67(1):16–28. Available from: https://sciendo.com/article/10.2478/agri-2021-0002
4. Turdaliev AT, Askarov KA. Energy characteristics of trace elements in saline soils of Central Fergana. Actual Probl Mod Sci. 2019;(6):83–87.
5. Turdaliev AT, Askarov KA, Mirzaev FA. Morphological features of irrigated soils in Central Fergana. Soils Environ. 2019;2(3):56–61. Available from: http://dx.doi.org/10.31251/pos.v2i3.71
6. Eshpulatov ShYa. Some historical features of the development of the Margilan oasis. Sociosphere. 2013;(2):58–60.
7. Eshpulatov Sh, Teshaboev N, Mamadaliev M. Introduction, properties and cultivation of the medicinal plant stevia in the conditions of the Ferghana Valley. Eurasian Union Sci. 2021;2(2):37–41. Available from: http://dx.doi.org/10.31618/ESU.2413-9335.2021.2.83.1253