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Agro-ores of Glauconite of Karakalpakstan as a Multi-purpose Mineral Raw Material

S. Bauatdinov
Karakalpak Scientific Research Institute of Natural Sciences, Karakalpak Branch of the Academy of Sciences of the Republic of Uzbekistan, City Nukus.

T.S. Bauatdinov
Karakalpak Scientific Research Institute of Natural Sciences, Karakalpak Branch of the Academy of Sciences of the Republic of Uzbekistan, City Nukus.

F.I. Khudoyberdiev
Nukus Branch of the Navoi State Mining Institute.

K.M. Djaksimuratov
Nukus Branch of the Navoi State Mining Institute.

Abstract **- The article presents the results of research on the agro-ore of glauconite of Karakalpakstan for its use as a multi-purpose mineral fertilizer. The results of the research showed that after the appropriate processing of enrichment, glauconite acquires high fertilizing properties, and its introduction into the soil contributes to the intake of phosphorus, potassium, nitrogen and trace elements into the plants, and increases the yield. Soil structure formation is improved.**

Keywords - Karakalpakstan, Mineral raw material, Soil structure.

INTRODUCTION

The importance of mineral fertilizers in increasing soil fertility and agricultural crop yields is well known. In addition to the well-known nitrogen, phosphorus and potash fertilizers, the use of trace elements that stimulate the growth and development of plants, increase the resistance of plants to drought, cold and some diseases is of great importance. In this regard, much attention is paid to the production and application in Uzbekistan and Karakalpakstan of mineral fertilizers based on local mineral raw materials, which include highly dispersed varieties of bentonite clays-glauconites containing in their composition from 4 to 6 % K2O from 0.16 to 0.41% P2O5 and a large set of trace elements, such as copper, zinc, molybdenum, cobalt, manganese, vanadium, titanium, nickel, barium, strontium.[1]

DATA

The presence of large areas of glauconite-containing sands on the territory of Karakalpakstan, the availability and large reserves dictate the need for their use as local mineral-agro-ores.

Glauconite is a mono-prismatic mineral, from the group of layered aqueous silicates, with a specific gravity of 1.7-1.9 g / cm^3.

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	Na_2O	MnO	P_2O_5
52.9	11.8	16.7	4.31	0.82	4.52	0.41	0.03	0.04-0.41

Glauconite by its natural structure is a mineral of greenish color, has the following composition:

Glauconite has high absorption and cation exchange properties:
Ion exchange capacity-0.1-0.4 mol / kg;
Porosity – 20-25%;
Hardness-1,3-2,0;
Density-1.8-3.0;

The particle size is from 0.03 to 0.65 mm.

The cation exchange capacity of glauconite concentrate varies from 390 to 550 mg / eq per 1 gram of sample. The mineral has the ability to selectively absorb cations and long-lived radioisotopes.

Maximum absorption capacity with respect to heavy metals: copper -781.2; nickel-342.4; iron-1317 mg / eq per 1 kg of mineral.

The ability of glauconite to extract heavy metals from solutions is (in % of the initial content):

Pb-99, Hg-64, Co-96, Cu-96, Mn-95, Cr -92, Ni-90, Zn-90, Fe-99.

The results of the studies show the ability of glauconite to sorb petroleum products and heavy metals, and that the maximum sorption capacity of glauconite, depending on the sorbed petroleum products, heavy metal ions and their composition, ranges from 13 to 60%.

According to its structural and geochemical properties, glauconite is a multi-purpose mineral raw material. The following applications of glauconite are suggested.

- As a hard water softener. One ton of glauconite softens 810m3 of water of any hardness. Glauconite can withstand more than 500 regenerations per year.
- For wastewater treatment from heavy metals. According to the Institute of Chemistry and Botany of the Academy of Sciences of Uzbekistan the salt content decreased during the wastewater treatment of the Tashkent cable plant:
  Copper – from 114.5 to 4.6 mg/l;
  Lead-from 375 to 2 mg/l;
  Zinc – from 380 to 40 mg/l.
- When refining petroleum products, glauconite showed a high sorption capacity to naphthanic acids-up to 6.4 per 100 g of glauconite and to pyridine-up to 5.79 per 100 g of glauconite. It is established that glauconite treated with a weak solution of sulfuric acid can be used for cleaning and clarifying motor oils.

Glauconite has the ability to absorb long-lived radionuclides CE-137 and Sr-90 reduces the total β-activity of water by 28-203 times and is used for decontamination of waters and soils with increased radioactivity. Moreover, glauconite is an active absorber of various organophosphorus, organofluorine and sulfur-containing pesticides, dramatically reducing their content in the soil and aquatic environment.

Studies show that the use of glauconite increases the accumulation of nutrients in the soil, improves the water-physical regime and soil structure, activates the activity of the soil microflora, as a result, increases the yield of cereals and legumes by 10-40%, root crops by 30-35%.

Glauconite has a positive effect on the yield of the green mass of annual grasses, corn, increases the germination rate (up to 40%) of legumes and cereals, reduces the incidence of plant diseases.

In livestock and poultry complexes, glauconite can be actively used as a feed additive.

According to the results of research conducted by scientists of the Ural state Academy of veterinary medicine, glauconite has a positive effect on the level of metabolic processes in the body of livestock and poultry, promote better absorption of nutrients-organic parts of food, is highly effective for micronutrient deficiency in the diet.

The feed additive in the diets of fattened pigs allows to increase the average daily gain of live weight by 19.8 %, and the average daily gain of calves (at a dosage of 0.15 grams of glauconite per 1 kg of live weight) is 49.3% higher than in the group of calves that did not receive glauconite.

- As the experiments of the Azov Research Institute of Fisheries and a number of other organizations have shown, the introduction of glauconite into ponds and reservoirs has a stimulating effect on the development of phytoplankton, accelerating the growth rate and increasing the weight of fish fry. When using glauconite, a biological outbreak of planktonic algae was obtained on the second day instead of the fifth, and their biomass was 8-15 times higher than the control one.
- Tests have established that glauconite sand can be an environmentally friendly and cheap filler in the production of building stones and tiles based on ferrochrome slag (belite) and liquid glass.

The optimal filler content is 5-10% by weight. In the same role, glauconite is recommended for use in the production of magnesite tiles, xylolite and injection molding products on a magnesia binder with a filler content of 5-10% by weight.

Total estimated reserves gluconasturtiin Sands on the territory of the Republic of Karakalpakstan are 40-45 million tons and potential reserves of about 70-80 million tons location: Krentowski, Hodzhalinskoe, Bilitewski, Kyzylzharskiy manifestation, manifestation Ketmeniense, Cuki Togame manifestation, manifestation Beschryvinge.

The potassium content in glauconites reaches 4-5 %, and it also contains about 20 trace elements (Zn, Co, Cu, Fe, Mg, Mn, V, etc.). [2]

The use of glauconite sands of Karakalpakstan directly as a microelement-containing fertilizer is of great economic importance for our region.

Glauconite-containing sands after appropriate processing acquire very high fertilizing properties. In the United States, for example, they are used directly for the production of potash fertilizers in the amount of 2600.0 thousand tons annually, and are also widely used in many foreign countries, such as the Netherlands, Canada, Italy, Israel.

The concentrate containing at least 85% of glauconite can be used for application to the soil at the rate of 60 kg / ha in the form of glauconite flour or as part of complex-mixed fertilizers. We have found that the introduction gluconasturtiin Sands for cotton and rice as microelementoses potash fertilizer increases yield by 4-5 quintals and promotes entry into plants phosphorus, potassium and micronutrients and improves resistance of cotton to the wilt verticillata.

In field experiments the Uzbek research Institute of cotton research Institute of agriculture (G. Chimbay) and the Institute rice (Nukus district), making Rantaeskola glauconitic Sandstone deposits in the dose of 800kg/ha led to the increase of raw cotton by 4.8 t/ha.

In addition, the introduction of glauconite-containing sands enriches the composition of the soil and increases the absorption of micro-macronutrients in the soil. Soil salinity decreases by 1.2-1.5 times. It should be emphasized that glauconite-containing sands retain their effect in the soil for a long time.

According to the conducted studies, glauconites, being a good meliorant on various types of soil, contribute to saving irrigation water by 10-15%.

The economic efficiency of reducing the application of nitrogen, phosphorus fertilizers by 15-20% and potash fertilizers by 70-80%, according to our calculations, is several billion sums.

The use of mineral fertilizers based on glauconite gives a constant increase in the production of agricultural products, improving their quality, safety and processing. The intensification of agricultural production requires an increase in crop yields based on the effective use of mineral fertilizers. To eliminate the shortage of fertilizers, it is necessary to use local raw materials-low-grade phosphorites, agronomic ores that do not have industrial significance.

The presence of large areas of glauconite-containing sands on the territory of Karakalpakstan, their availability and available reserves create a favorable ground for their use as raw materials in the production of local mineral fertilizers.

The use of glauconite sands directly as an agronomic fertilizer and the production of mixed microelement-containing fertilizers on their basis is of great socio-economic importance, especially for our region. The implementation of the technology for the production and enrichment of glauconite, on the one hand, will create a technological base for the search and development of local mineral resources and the improvement of the technology for the production of mineral fertilizers.

The content of a sufficient amount of moisture in the soil is a necessary condition for the normal development of plants, it has a great influence on the supply of nutrients to them.

With a normal level of mineral nutrition elements in the soil, there is no direct dependence of the amount of their intake into the plants on the intensity of transpiration. However, with an excessive content of macro-and microelements in the external environment, their intake into plants increases with an increase in the rate of transpiration.

The influence of soil moisture on the supply of nutrients to plants is mainly determined by the following physiological and physico-chemical factors.

When studying the processes of soil phosphoric acid mobilization in chernozems and other soils, a direct relationship between humidity and phosphorus content in the soil was found.

At the same time, the influence of the soil itself on the mobilization of P2O5 is enhanced by the fact that with optimal soil moisture and sufficient heat, the most favorable conditions for microbiological processes are created, as a result of which acids are formed that increase the solubility of phosphates in the soil. This leads to the practical conclusion that the accumulation of moisture in the soil, the preservation and reasonable use of it, will create favorable conditions for the mobilization of soil phosphates. Therefore, the struggle for moisture is also a struggle for the phosphoric acid absorbed by plants.

The influence of soil moisture on the supply of nutrients to the plant is mainly determined by the following physiological and physical factors.

- Improvement of the general physiological state of plants, since the normal hydration of tissues contributes to the improvement of photosynthesis, protein biosynthesis and some other metabolic processes, which largely determine the absorption of nutrients by plants.
- Improvement of the development and location of the roots with a normal moisture content in the soil and an increase in their overall absorption capacity.
- The versatility of water as a medium for the diffusion of ions from the soil solution and the soil absorbing complex to the root hairs of plants. These factors are associated with the positive effect of soil moisture on the intake of macro - and microelements in plants. An increase in the total intake of N, P, K, Ca, Mg, Zn, Cu, Mn, Co, Fe, Mo, and B was found in plants with optimal soil moisture. With a lack of moisture, the assimilation of food elements by plants is difficult.

The negative effect of excessive soil moisture on the absorption of nutrients can manifest itself in a unilateral increase in the availability of certain ions, in particular iron and manganese oxides, the accumulation of which in plants in this case reaches a toxic level. With a lack of moisture, the consistency in the work of enzyme systems is disrupted, the processes of hydrolysis and decomposition of organic substances increase, the intensity of photosynthesis decreases sharply, and plant growth stops.

It should be noted that only about 0.2 % of the water absorbed by the roots is spent on building the body of the plant, over 99 % of it evaporates. The water consumption required to create a unit of dry matter is significantly reduced in conditions of sufficient supply of plants with mineral nutrition elements.

The best conditions for the supply contribute to a more productive use of moisture. In turn, with sufficient moisture supply, the return on fertilizer application increases, which is shown by the practice of using fertilizers in irrigated agriculture. [3]

The high absorption and ion exchange capacity of glauconite increases the water-retaining properties, which contributes to a more efficient use of the nutrients contained in the soil itself. By improving the adsorption properties of the soil, the efficiency of fertilizers increases. This property is especially important for the conditions of Karakalpakstan, since in low-water years the agriculture of Karakalpakstan experiences an acute shortage of water resources. The introduction of glauconite into the soil will increase the water-retaining property of the soil. This will gradually transfer moisture from the soil to the plants. [4]

We have studied the water-retaining property of glauconite, which was confirmed in field studies conducted in 2013-2019 in the Republic of Karakalpakstan. Experimental studies were conducted in the cultivation of cotton.

To study the effect of the introduction of glauconite on the yield of cotton, special studies were conducted at the experimental site. On the first plot, cotton was grown according to standard technology. For comparison, cotton was grown in a neighboring field using the same technology, but with the introduction of glauconite. This year was low-water, so due to the lack of water, both plots were insufficiently watered, i.e. one incomplete watering was done on both plots. Under the same conditions, the yield of cotton grown without application was 13.5 c / ha, and the yield of cotton grown with the introduction of glauconite was 25.2 c / ha. [5]

TESTS AND RESULTS

The results of special studies conducted at the experimental site of the Karakalpak branch of the Academy of Sciences of the Republic of Uzbekistan confirm that glauconite has water-retaining properties. The results of these studies are presented below.

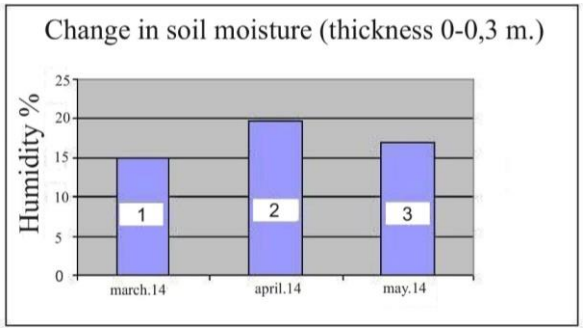

FIG. 1
EFFECT OF GLAUCONITE APPLICATION ON SOIL MOISTURE

1-before applying glauconite when the soil is wet in a non-sticky state: 2-after applying glauconite when the soil reaches a non - sticky state after watering, 3-a month after the soil reaches a non-sticky state.

Studies have shown that the introduction of glauconite contributes to an increase in the content of humus in the soil.

Figure 1 shows graphs of changes in soil moisture (thickness 0-0. 3 m) before and after the introduction of enriched glauconite. The analysis of the experimental results shows that the soil in a non-moving state, with the introduction of glauconite, has a higher humidity compared to the humidity of the soil, without the introduction of glauconite. This indicates that glauconite has a water-retaining property.

At the experimental site of the Karakalpak branch of the Academy of Sciences of the Republic of Uzbekistan, special studies were conducted to study the effect of glauconite on the content of humus. In these studies, enriched glauconite (60%) was added to the soil (thickness 0-0. 3 m) at the rate of 800 kg / ha. Figure 3 shows a graph of changes in the humus content in the soil over the years, the analysis of which shows that from year to year there is a significant increase in the humus content in the soil. For example, in three years, the humus content in the soil increased from 0.08 to 1.48 percent.

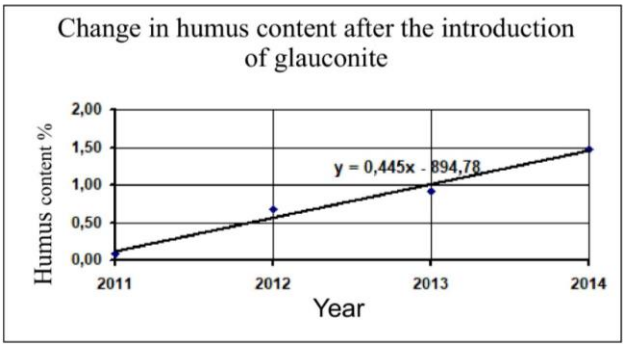

FIG. 2
THE EFFECT OF GLAUCONITE ON THE HUMUS CONTENT

Humus plays a great role in improving the physical properties of the soil and creating an optimal water-air regime. It has a significant effect on the thermal balance of the soil, on the volume mass, the specific gravity of the solid phase, on the formation of physical and chemical properties. Humus acts as an energy accumulator on the earth's surface.

CONCLUSIONS

The accumulation of humus in the soil is possible when applying high doses of organic fertilizers prepared on the basis of peat. Together with peat, "ready-made" humic acids enter the soil, the content of which in peat is about 40%. But there is no peat in Uzbekistan.

A good source of raw materials for obtaining highly effective organic and organomineral fertilizers could also be hydrolysis lignin-waste from biochemical production, as well as agricultural ores and waste from animal husbandry and crop production. [6]

Physical and chemical analyses show that glauconites contain organic residues, which are the basis of organic substances and humus. Thus, glauconites should be considered as a multifactorial fertilizer that not only enriches the soil with potassium, phosphorus and trace elements, but also improves its structure, retains moisture, stimulates growth and reduces the incidence of plant diseases.

REFERENCES

[1] Bauatdinov S. Agro-ores of Karakalpakstan and fertilizers based on them. *Nukus "Ilim"* 2019, 321-330

[2] Bauatdinov S., Bauatdinov T.S. Glauconites of Karakalpakstan and their application in agriculture. *Nukus "Ilim"* 2013, 53-55

[3] BA Yagodin Agrochemistry M .: Kolos, 1982, 550-570

[4] Formozova LN Glauconitis. M., 1949. 223-225

[5] Report on the project "Creation and introduction of complex-mixed fertilizers using glauconites of Karakalpakstan" (2012-2013). *Nukus*, 2013.-75 s

[6] B.M. Beglov, Sh.S. Namazov, B.S. Zakirov, M.O. Zhumanov, N.Kh. Usanbayev *"Organic mineral fertilizers based on brown coal"*. Tashkent 2018, 125-135

[7] http://glaukonit.com/