SAPROPELIC SEDIMENTS OF THE VOLGA-AKHTUBA FLOODPLAIN

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Abstract. The widespread development of human civilization leads to the improvement of production potential in any of its manifestations. The question arises in which aspect: positive or negative? The harmonization of human activity with the natural components of the geographical envelope is the true achievement of civilization, to which it is necessary to strive and develop.

Key words: soil fertility, sapropel deposits, classification of silt deposits, organic matter, land reclamation.

At different stages of historical agriculture, there is a need to apply technological methods to improve the quality of soil, which is accompanied by limited territorial aspects for a particular farmer and for the country as a whole. In the modern world, the growth trend of the Earth's population is clearly manifested, which provokes an increase in agricultural products, since it is a priority for the derivative viability of this very population. When there is a demand for such a derivative, there is a desire to produce more goods, invest less, and get more profit. This works quite well in many areas of production, but not in agriculture. Agriculture has a number of limiting factors in limiting the trend, such as climate conditions, territorial aspects, and the degree of development of a given state. The higher the state's development level, the higher the level of protection of agriculture. This is where the question arises: how to get high-quality products, what technological techniques to use and how these techniques will affect further productivity?

The answer can be found in the words of Lucius Junius Moseratus columella (1 century ad) "the Earth does not age and does not wear out if it is fertilized." Only the one who will take care of soil fertility who understands that the "tired earth" syndrome is as difficult to treat as any disease, so timely measures taken to preserve and improve fertility are the key to obtaining high – quality predicted products.

For this period of time, quite a lot of research has been conducted on the fertility of soil resources, there are works that address the issues of substantiation of quantitative assessment indicators of the health and quality of soils in agro-and sociospheres, which allow monitoring these soils and making informed decisions about the need for their improvement [6].

Throughout the history of agriculture, various technologies have been used to improve the quality of soil indicators, and we propose to consider one of them in this article, where it can be supplemented by works devoted to the improvement of soil agroecososes. [7, 11]

Sapropel deposits or sapropel in the Large dictionary of foreign words (publishing house "IDDK" from 2007) is interpreted as:
"...sapropel [from the Greek sapros-rotten and pelos-mud, silt] (special). 1. Silty rotted sediment of plant and animal origin at the bottom of closed water basins (swamps, lakes). 2. Combustible material from such deposits (tech.)" [2].

The term itself was proposed by the German scientist Lautenborn at the beginning of the XX century for the classification of lake deposits.

On the territory of Russia, silt deposits were also used, but scientific research on the study of the fertilizing properties of silt deposits begins only in 1912.

These works arouse interest, and since the 1930s this topic has been widely spread.

The use of sapropel deposits as fertilizer is of particular interest in a number of farms in the European part of the RSFSR, Belarus, and the Baltic States.

In foreign practice, the properties of sapropel deposits are also studied with the adoption of special programs for the restoration of lakes with the subsequent use of silt deposits in the form of fertilizer. Research takes place in countries such as Sweden, Germany, Poland, Japan, Slovakia, Czech Republic, etc.

The properties of silt deposits are studied everywhere: by the content of organic matter, by structural features, by the predominance of components in the mineral part, by biological origin, reading individual characteristics and properties. Let's consider some classification of sapropel deposits, taking into account their qualitative differences, namely:

1. according to the content of organic matter (more than 15%), silt deposits are divided:
   - low-ash, medium-ash, high-ash and high-ash. As a percentage up to 30%, 30-50%, 50-70%, 70-95% accordingly. On the territory of Belarus, silt deposits are classified only in two parameters, namely low-ash (the ash part is less than 30%) and multi-ash (from 30% and higher). Multisols, in turn, are divided into calcareous and carbonate (the content of calcium oxide is more than 30%, silica is more than 50%, and mixed with an equal amount of CaO and SiO2);
   - for organic, organo-clay, organo-calcareous and calcareous sapropel.
2. by chemical composition, which is extremely heterogeneous.
3. The content of microorganisms.

Since the mid-60s of the last century, a large number of various studies of sapropel deposits have been conducted on the territory of the USSR. Questions on fertilizing qualities are considered, calculated and systematized by quantitative reserves, the thickness of deposits is determined, new formations of sapropel deposits are predicted, methods of extraction and transportation are worked out, and research is conducted using various scientific aspects.

The literature sources developed by us have revealed that the numerous studies that were conducted on the territory of the USSR, and later in the Russian Federation, do not give a complete description of sapropel deposits. There are many questions about classification, fertilizing qualities, application methods, accumulation factors, etc.

The result of the above may be an ambiguous formulation: sapropel deposits are a nature-saving resource that needs to be qualitatively investigated with the help of modern equipment based on existing experimental indicators.

The main issue of our research is the study of sapropel deposits of the natural-territorial complex of the Volga-Akhtuba floodplain. The materials of this study were tested at scientific events of various levels. [13,14,18]

The territory, which is unique in its characteristics, has formed such biosphere indicators that contribute to the formation of sapropel deposits on this territory.

Many scientists have paid attention to the research of silt deposits of the Volga-Akhtuba floodplain, and there are a large number of scientific papers and research on this topic. Scientists such as T. I. Arshinova, V. A. Filimonova, M. S. Grigorov, and A. S. Ovchinnikov have devoted many years of research.

T. I. Arshinova predicted reserves of sapropel deposits of the Volga-Akhtuba floodplain within the Volgograd region up to 20 million m3 in the solid phase.
M. S. Grigorov says that only 70 studied reservoirs in the Northern part of the Volga-Akhtuba floodplain (total area – 5962 ha) volume of silt deposits amounted to more than 28 million m³ in the solid phase, and predicted reserves of more than 50 million m³.

When conducting research on the use of sapropel deposits, first of all, the main task of reclamation should be implemented, namely, a system of organizational, economic and technological measures aimed at radically improving agricultural land by regulating its water (and associated air, nutrient and heat) regime to increase soil fertility. [8]

When considering the introduction of sapropel deposits into the soil structure as a meliorant, it is necessary to conduct a chemical analysis of this raw material. These studies are necessary, due to the heterogeneity of deposits, to determine the degree of safety. First of all, we consider such indicators as: humus, organic matter content, mobile compounds of nitrogen, potassium and phosphorus, anionic and cationic composition, etc. One of the main indicators of organic matter classification is ash content. So M. S.’s research According to Grigorov, the ash content of sapropel deposits of the Volga-Akhtuba floodplain ranges from 92 to 97% on dry matter, which suggests classifying them as mineral.

According to the existing classification, organic matter must be at least 50% for organic sapropel, 15% for organo-calcareous and 30% for organo-siliceous. As mentioned earlier in the article, the existing classification indicators cannot be a measurement indicator because even such high-ash deposits show good results with a combination of controlled factors. T. I. Arshinova draws attention to this in her works back in the 50s of the last century. [17]

Our research is aimed at studying sapropel deposits of the Volga-Akhtuba floodplain. The subject of the study was silt deposits of water bodies of the Volga-Akhtuba floodplain in the Astrakhan and Volgograd regions.

When using sapropel deposits as a meliorant, to improve the fertile properties of the soil, it is necessary to analyze the source material for chemical content, we will give an example of studies on samples to clarify the spectrum of consideration (table 1).

**Table 1. Properties of silt deposits, % on dry matter**

| № sample's | pH     | Organic matter | Ash content | Nitrogen | Phosphorus | Potassium |
|------------|--------|----------------|-------------|----------|------------|-----------|
| 1          | 6.80   | 10.4           | 91.2        | 0.46     | 0.45       | 0.16      |
| 2          | 5.90   | 13.55          | 73.9        | 0.97     | 0.25       | 1.69      |
| 3          | 7.29   | 6.85           | 86.3        | 0.55     | 0.25       | 2.24      |
| 4          | 5.96   | 9.75           | 80.5        | 0.78     | 0.31       | 1.74      |
| 5          | 6.71   | 8.85           | 82.3        | 0.64     | 0.41       | 2.12      |

According to the content of organic matter, these samples should be attributed to high-ash, while the reaction of the medium is slightly alkaline, which will have a good effect when applied to slightly acidic soil, since the reaction of the soil solution is alkalinized and enters close to neutral.

One of the important indicators for the use of fertilizer techniques is considered to be acidity, which is determined by the pH indicator (negative decimal logarithm of the concentration of hydrogen ion in the soil solution). It is important to take into account environmental response indicators, as they significantly affect the growth and development of plants, microbiological activity, the flow of biochemical processes, and the assimilation of nutrients by plants. The recommended pH in the salt suspension is higher than 5, while the toxic reaction occurs at values equal to 8.0...8.5, when the ionic equilibrium is disturbed. The observed samples showed a favorable pH environment.

One of the most important values is the ability of the soil to provide plants with nutrients. Plant communities can absorb compounds from the soil that are soluble in water, weak acids, and the metabolically absorbed state. Sapropel deposits contain all the vital nutrients that accompany the improvement of soil fertility.

These samples were also examined for the content of heavy metals, the analysis showed that the excess of these indicators (MPC in the soil equal to 1500 mg / kg) was not detected.
Thus, these samples can be used as fertilizer forms to improve water-physical soil properties. The properties of sapropel deposits are determined by geographical indicators and are characterized by climate-forming factors. Therefore, when considering sapropel deposits as fertilizing measures, it is necessary to consider only the specific type of reservoir and the soil structure of the experimental site. Only with this consideration can we talk about the success of the introduced ameliorant.

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