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On the need for creation of a computer bank and cadaster for data on peat. Recomendations on processing

L.M. Krivoputskaya

Rational utilization of raw materials and effective control of their use calls for creation of computer data banks on the state of natural resources.

The necessity of creation of a data bank on peats is obvious.

First, Russia occupies a highly important place in the world's resources of peat. The distribution of peat resources at the territory of Russia is, however, nonuniform. Siberia is especially rich in peat soils. As much as 3/4 of all peat resources are in Siberia and Far East, and only 1/4 of them is in the European part. This must be taken into account in location of peat processing centers.

The area occupied by peat soils should also be taken into account. Peat shows with areas of less than 100 hectares prevail at the territory of Russia. Primary reserves of peat are in deposits with areas of more than 1000 hectares.

Second, more and more interest is being shown in peat fertilizers, because chemization of soil which provides a reliable increase in yield leads to formation and accumulation of toxic substances, such as ions of heavy metals, nitrogen nitrates and nitrites, in soil, ground waters and plants.

Peat is a raw material which is ecologically clean and does not pollute the environment. Peat fertilizers have high adsorption capacity and buffer action. Their use provides high productivity of plants without pollution of soil. The quality of production increases. The content of nitrogen compounds in products is lower. Tolerance of plants for unfavorable environmental conditions is higher.

Introduction of humin or peat-humin fertilizers into the soil containing high concentrations of mineral fertilizers prevents their washing out and, hence, environmental pollution. It allows no accumulation of the nitrate and nitrite forms of nitrogen in plants. They are bound into inactive forms. The effectiveness of nitrogen fertilizers thereby increases.

It should be noted that the ecological factor, the expedience of applying peat fertilizers and, hence, the necessity of development or choice of ecologically clean technologies for their production, call for searching fertilizers that could compensate for nutrient components of the soil taken by plants, especially during rich yields.

Organic matter, macro- and microelements are the primary nutrients of the soil. Humus is the basic component of the organic matter of the soil. It is the main source of all nutritious elements of plants and a regulator of most important physical-chemical, biological, heat and technological properties of the soil. Organic matter which forms the soil and changes its properties liberates carbon dioxide during decomposition. Carbon dioxide is assimilated by plants in the process of photosynthesis, i. e., humus forms the nutritious and water-air regime of the soil.

No matter how rich the soil may be in humus, macro- and microelements, it gets depleted with time. Organic and mineral fertilizers containing a sufficient amount of chemical elements necessary for the development and growth of plants are introduced into the soil to maintain its fertility.

Humus and other wastes of stock-breeding are often used as an organic fertilizer. Even on a balanced farm with joint plant growing and stock-breeding introduction of humus into the soil does not compensate for nitrogen, potassium, phosphorus, and other macro- and microelements taken from the soil by plants. Therefore, mineral fertilizers are introduced into the soil to replenish the deficit of nutrients. As noted above, this leads to pollution of the environment, and the humus component is not replenished. Peat fertilizers are the best compensators of the humus component. Peat is not a fertilizer in its native state, because it contains iron and aluminum oxides and is characterized by high acidity and low activity of the biological processes. Introduction of peat into the soil in the pure state does not lead to a yield increase; it sometimes results in its decrease.

At the same time, peat contains all nutrients necessary for the growth and development of plants in a balanced proportion: the humus component (humin compounds), macro- and microelements (N, C, K, P, Ca, Mg, Al, Fe, Si, Mn, S, Ag, Au, Ti, Co, Mo, Cu, B, Zn, V, Ni, and others), i. e., peat is a potential supplier of the humus substance, macro- and microelements.

Currently the number of plants producing peat fertilizers is increasing. An analysis of their production shows, however, that it uses peat from the nearest shows, its role in the ecological equilibrium of the region, the supplies, their replenishment, composition, the physical-chemical and agronomic properties of the region are not taken into account. The biological activity of the fertilizers, the character and extent of their enrichment with macro- and microelements depend on these properties. Besides, the quality of the fertilizers is poor: extraction of the humus component (2–10% of the content in the initial raw material) is low, mineral salts are added. This leads to unprofitable utilization of the natural resources which are practically irreplaceable. Therefore, information on the existing production technologies of peat fertilizers, their advantages and disadvantages, applicability to various types of peat and peat shows must be accumulated and supplemented in a computer data base.

To make a justified choice of a technology for fertilizer production and its regimes, some physical-chemical and agronomic properties of peat that determine it types must be taken into account in the computerization. There exist several peat types, the main of which are: upland peat, middle peat and lowland peat. Upland peat is not usually used in the production of fertilizers due to its low decomposition. Therefore, only technologies which make it possible to increase the degree of decomposition can be used in the processing of upland peat. This must be taken into account in the recommendations on utilization of upland peat.

Let us dwell on the number and composition of the mineral components of peat. Peat with normal ash content (up to 12%) and high ash content (up to 40%) is distinguished depending on the mineral regime. Peat with normal ash content contains more organic matter, but less potassium, phosphorus, and other macro- and microelements. High-ash peat contains less organic matter, but the number of chemical elements is larger. Vivianite peat is of special value. Phosphate, e. g., vivianite, which contains in the pure state up to 28% of P_2O_5 predominates in it.

An analysis of publications ([1–10], and some others), and our data for the element composition of peats show that peat soil which is in equilibrium with the natural waters, has high permeability and strong complexing agents, such as humic acids, actively sorb the elements available in these waters. It was established by S.M. Manskaya in experiments [2, 3] that decomposing peaty wood intensively absorbs ions of metals from solutions. In particular, wood peat is an active concentrator of germanium, the content of which in peats reaches 185 g/t.

These data are supported by investigations of Yu.A. Tkachev [4]. They show that a high concentration of germanium and other elements, in particular, rare metals, in coal seams results from their accumulation during the peat process. Concentration of rare and noble metals (Sc, Ag, Au, La, Y, Yb, Zr) was observed by us in peats of the Chany and Tolmachyovo deposits.

Peaty waters which are aggressive due to their acidity dissolve the mineral component, and the elements that go into solution also increase their peat content. Elements-admixtures released as a result of structural reconstructions of minerals that are not stable in acid media go into peat soils. Conversion of montmorillonite to kaolinite in peat soils can serve as an example of this [5].

It follows from an analysis of literature that peat is a powerful concentrator of chemical elements. Not all the elements, however, can be accumulated in peat. In accordance with the data of A.P. Lopatkina [6, 7], peat soils can be enriched with uranium up to 325 g/t.

Nevertheless, the experiments of S.M. Manskaya [2, 3] and A.V. Kochenov et al. [8, 9] show that in a normal peat process uranium is not absorbed by peat, but is carried away from the peat soil. This is because peaty waters are acid, and uranium mineralization is possible only in an alkali medium and in the presence of nitrous compounds. For example, we have not found any toxic elements, such as U, As, Sb, Hg, Tl, in peats of the Chany and Tolmachyovo regions.

The analyzed data show that acidity and the reduction-oxidation potential of the water medium both in the process of formation of peat deposits and after it, besides the composition of peat waters and the mineral component, are factors that influence the character and number of elements accumulated in peat. The values of these physical-chemical parameters must also be taken into account in preparation of a data bank and development of recommendations on the use of raw material.

The knowledge of the availability and concentration of chemical elements, especially precious metals and toxic compounds, in peat is necessary for extraction or isolation of these elements in peat processing. Then they can be either buried or used as chemical reagents. Precious metals can be accumulated in wastes of production; thereby their concentration can be increased, and they can serve as a raw material of noble and rare metals. At a rational approach to peat raw material, extraction of precious metals is quite real. In fact, it is known [10] that earlier germanium and potassium were extracted from coal ash.

For rational utilization of peat reserves, effective control of their processing, a computer data base must include the following 29 basic parameters:

1. Organic-mineral composition;
2. Element composition;
3. The number and composition of inorganic components;
4. The number and composition of organic components;
5. The relation between the inorganic and organic components;
6. The granulometric composition;
7. The hardness index;
8. Ash content (per cent content and composition of ash);
9. Calorific value;
10. The content of precious (rare and noble) metals;
11. The content of toxic elements;
12. Biochemical resistance;
13. Moisture-and gas-absorbing ability;
14. Ecological cleanness;
15. The extent of peat decomposition;
16. The content of phosphorus, its forms and the degree of mobility;

17. Acidity (pH);
18. The reduction-oxidation potential;
19. The area, depth of occurrence, thickness and size of peat seams;
20. The geographical position of the deposits;
21. Peat reserves in administrative areas and in the region on the whole;
22. A map of peat deposits;
23. Data on communications and the infrastructure of adjacent regions;
24. Prices of raw materials, such as peat, reagents, end products;
25. Market capacity:
26. Specific estimate of the commercial cost of peat;
27. Potential consumers of liquid, pasty, or dry fertilizers depending on the geographical position of the deposits and consumers;
28. The existing and potential plants for peat processing;
29. Recommendations on the use of peat:
    (a) Energetic use:
        i. Brick fuel;
        ii. Greenhouse substrate;
    (b) Preservation for further decomposition;
    (c) Technological utilization:
        i. Raw material for production of :
            A. Organic-mineral (peat-humin) fertilizers;
            B. Organic (humin) fertilizers;
        ii. The use of wastes of fertilizer production:
            A. To extract precious metals;
            B. For construction purposes (filler of concretes, road covering);
            C. To bury toxic elements and compounds.
    (d) Proposal of an optimal technology for production of fertilizers or their combination for each type of peat or peat show;
    (e) Proposal of optimal places for construction of plants for processing of raw material.

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