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ADVANTAGES OF PREPARATION AND USE OF BIOFERTILIZERS FROM BIOMASS OF HIGHER AQUATIC PLANTS

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ANNOTATION

This article contains materials on the prospects for using biomass of higher aquatic plants (Azolla - A. caroliniana Willd.; Eichornia - E. crassipes Solms.; Pistia - P. Stratiotes L.; Ryaska - L. Minor L.) as cost-effective, environmentally friendly safe, providing increased soil fertility and additional nutritious bio-fertilizers for plants in agriculture.

KEY WORDS: ***azolla, duckweed, eucalyptus, pistachio, biofertilizer, biomass, mineral fertilizer, humus, organic fertilizer, high-water plants.***

I. INTRODUCTION

Our country is distinguished by a wide variety of vegetation cover. Currently, introduced plants from different regions further enrich our flora. In order to effectively use natural and introduced promising plants, it is necessary to deeply study their bioecology, morphology, biotechnology, agricultural technology and other useful properties, as well as to introduce their results into the national economy.

In recent years, all over the world, including in Uzbekistan, as a result of intensive use of land resources, there has been a decrease in the amount of humus and nutrients in the soil, as well as a shortage of some elements. The main reason for this is that every year more and more nutrients go out of the soil together with the harvest and less comes back, that is, the balance of output and intake is disturbed. This situation leads to a decrease in the resistance of soils to anthropogenic influences, increased erosion processes, deterioration of their physico-chemical properties, violation of the aggregate composition, which is considered agronomically valuable. In a word, soil degradation is taking place. Therefore, in order to increase soil fertility, enrich them with organic matter and nutrients, and obtain high yields of agricultural crops, it is advisable to widely introduce organic fertilizers, crop rotations and a number of other agrotechnical measures into agriculture.

Currently, there is a wide variety of ways to prepare fertilizers, and the method of preparing biological fertilizers is the most effective. Therefore, conducting scientific research in the field of studying methods of preparation of biological fertilizers and their objects, that is, plants and microorganisms used in this process, are of great importance. Because increasing productivity is possible only with a comprehensive study of the physiology of plant growth and development, antomorphological changes in them.

Of great scientific and practical importance today is the study of how effective the biological method of increasing soil fertility is in agriculture, that is, the preparation of biological fertilizer from the biomass of higher aquatic plants (Duckweed, azolla, pistia and eichornia) and its application in agriculture. They tend to accumulate significantly more chemical elements in their green biomass than other plants.

The biofertilizer obtained as a result of research is environmentally friendly, cost-effective, when used in agriculture additionally enriches the organic composition of the soil and does not adversely affect its properties. The correct and effective use of new acreage, greenhouses and household plots of the population, as well as the correct choice of fertilizers during their processing are important.

Higher aquatic plants (macrophytes) are one of the most important components of aquatic ecosystems. They serve as an indicator of the processes of eutrophication and pollution of water resources. Of the higher aquatic plants, the body of which is somewhat soft (Potamogeton crispus L., Ceratophyllum demersum L.,) are considered the main food for the Amur white (Ctenopharingodon idella) fish. Rich in protein - higher aquatic plants like Duckweed (Lemna minor L.) are specially bred and given as food to young fish, they grow very well, gain full fat and in one season acquire the appearance of commercial fish.

Another important function performed by macrophytes is to obtain nutrients dissolved in water (N and P). Macrophytes are widely used all over the world to purify excess nitrogen and phosphorus from polluted water in wetlands.

Pistia, eichornia and azolla are perennial plants floating on the surface of the water, widely distributed in tropical and subtropical regions. Currently, these plants have been successfully introduced in the conditions of Uzbekistan. An incredible amount of biomass is formed from these algae. The biomass of algae can range from 6-14 g to 34 kg per 1 m3 of water. 1 ha of algae accumulates up to 100 tons of wet and 10 tons of dry mass. Planktonic algae, which grow round without attaching anything in the water, are of great importance in the nutrition of animals.

For example, azolla is a small (0.7-1.6 cm) aquatic plant floating on the surface of the water. He has a root in the underwater part, a small leaf in the upper part and a shoot in his armpit. The presence of a separation layer at the junction of the shoot with the stem is the main criterion for vegetative reproduction. Each azolla leaf consists of two segments. The pigment in the surface part of the water is covered with a natural photosynthetic pigment, forming several layers of small cells. The lower segment, having a flat shape and consisting of bordered (1-2 pcs.) cells, but without chlorophyll, is immersed in water (0.2 mm).

A leaf is formed on the water surface of the azolla, which has a photosynthetic multilayer cell. It is in this part of the leaf that the process of fixing free nitrogen in the atmosphere takes place. The azolla root in the underwater part has a length of 1-1.5 cm, starting from the part that touches the water. A separating layer is formed from the place of contact of concrete with the root. With the formation of root hairs, the outer cover sheds the bark, eventually preparing the soil for the separation of a new plant. Because azolla is a plant that mainly reproduces vegetatively. To do this, the side branches are easily separated from the main stem and diverge around the circumference with a jet of water.

Azolla grown in wastewater can produce up to 1500-2000 kg of wet biomass per night from 1 ha of water surface; pistia and eichornia -up to 1800-2700 kg of wet or up to 90-135 kg of absolutely dry biomass (from June to October).

II. METHODS

A.caroliniana Willd. the species systematically belongs to the section Polypodiophyta, class Polypodiopsida, genus Salviniales, family Azollaceae and is considered a forage, technical and decorative (floating on the surface of water, reaching a size of 0.7 - 1.8 cm) plant. The species was introduced from the Institute of Soil Science and Photosynthesis of the Russian Academy of Sciences in 1991 and introduced in the laboratory of "Algology and Hydrobotany“ of the NPCBotany" AN RUz. The growth and vegetative reproduction of azolla was carried out on the basis of determination of alkalinity, acidity (pH) and water temperature in the process of phenological observations.

The methods of T. Taubaev (1970) and V.M. Katanskaya (1981) were used to determine the yield of caroliniana per 1 m2, and the methods of D.V. Dubina and V.V. Protopopova (1983) were used in the study of reproduction. Determination of nitrogen-fixing activity of caroliniana was carried out by the acetylene reductase method of R.W. Hardy et al. ((1968) in an LC-80 gas chromatograph with a flame ionization detector, and the results obtained were expressed in nanomoles by F. Gerhardt et al. (1983).

As a result of many years of scientific research conducted at the Institute of Botany of the Academy of Sciences of the Republic of Uzbekistan, a new effective biotechnology of biological purification of agricultural (livestock and poultry complexes), industrial enterprises (processing of hemp, production of mineral fertilizers, biochemistry, fat-and-oil enterprises, sericulture enterprises, textile industry) and municipal wastewater from organomineral substances, heavy metals, cyanides, petroleum products and pathogenic microorganisms using eichornia and azolla was created.

An important task that we have to accomplish today is to improve the condition of the soil, increase its fertility and form the necessary

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minerals for plants by developing a technology for preparing biofertilizers from the obtained biomass of these higher aquatic plants. Based on this task, in order to obtain a sufficient amount of biomass from higher aquatic plants, we created an artificial reservoir and grew them for 40 days. We used composting and drying methods to obtain biofertilizers from the resulting biomass.

Method of compost preparation:

- Digging of soil with a size of 2 m x 2 m;
- Instillation from the mass of eichornia into a 1-layer 20 cm thick;
- Instillation from the azolla mass into a 2 - layer 20 cm thick;
- Instillation from the mass of duckweed into a 3-layer 20 cm thick;
- Instillation from the mass of pistia into a 4-layer 20 cm thick;

Drying method:

Preparation of organic fertilizers by drying from the resulting biomass in two different ways:

- in the shadows
- under the influence of sunlight.

III. RESULTS

When we used the composting method, it was found that in the mixture prepared from algae, the content of organic matter, nitrogen, CaO, Fe2O3 is significantly higher than usual. We found that the mineral component is relatively larger in the eichornia biomass, and the P2O5 content is relatively higher in the mixture of azolla and eichornia. When using the composting method, we obtained the following results (Table 1):

Table 1.
In 100 g of biofertilizer per g of dry weight

Components	Azolla+ eichornia	Azolla+ Ryaska	eichornia	Azolla+ pistia	Azolla+eichornia+ Ryaska
Organic substances	36,8	20,62	18,51	26,17	41,27
Mineral substances	63,2	79,38	81,49	73,83	58,73
P_2O_5	1,05	0,59	0,3	0,64	0,91
N_2	2,05	0,65	0,57	1,24	2,25
CaO	10,26	8,79	9,02	8,97	10,39
Fe_2O_3	2,12	2,34	2,53	2,24	2,55

Biofertilizer was made from azolla (an aquatic plant), samples of which were subjected to chemical analysis at the Institute of General and Inorganic Chemistry, and the following results were obtained (Table 2).

Table 2.
The chemical composition of the biomass obtained using the compost preparation method is calculated as a percentage.

Component	Azot (N)	Organic substances	Humi dity	Ash	CaO	MgO	P_2O_5	Fe_2O_3	Al_2O_3
Green dried biomass in the vegetative period	4,98	51,82	8,07	40,11	8,6437	2,182	0,714	0,7741	2,3384
Red dried biomass in the generative period	1,69	27,78	42,2	29,96	5,8152	1,1175	0,4734	0,5033	1,3871
Wet biomass in the vegetative period	0,92	5,61	89,64	4,75	1,0692	0,1705	0,1382	0,0865	0,2057
Wet biomass in the generative period	0,93	5,87	90,46	3,67	1,1227	0,1508	0,0473	0,0918	0,1618

According to the results of the analysis, it was found that the green dried biomass of biofertilizer contains 5 percent nitrogen, and the biomass that has completed its natural growing season in the reservoir contains 3 percent nitrogen. The content of organic substances in the composition of biofertilizer - up to 52%, calcium and magnesium oxides -10%, P2O5 - 0.7%, iron and aluminum oxides - up to 3%, indicates that it is rich in natural macro- and microelements.

1 ha of land of the farm “Kahramon” The Karmaninsky district of Navoi region has been allocated for a pilot site and the potato variety “Santa" has been planted. After plowing and irrigation were carried out in the same manner, half of the area (0.5 hectares) was treated with organic fertilizers – manure and potatoes were planted. And the other half was planted with biofertilizer, prepared in a composite way from our tall plants, in the form of an underlying layer under potato beds.

By the end of the season, that is, 80 days after planting potatoes, the crop was harvested, and the results showed that in the variant treated with biofertilization, potato tubers with a diameter of 1 to 5 cm larger than in the variant treated with manure were formed, and from each plant it was possible to collect from 0.5 to 2 kg more than in the control variant.

Using the example of nitrogen fertilizers for comparative comparison, it can be said that in sodium nitrate the content of pure nitrogen is 15-16%, in potassium nitrate-12-13%, and in ammonia-30-35%. It is known that for the full germination of sprouts, acceleration of the phases of development in plants, cultivation of melons and vegetable crops, as well as a plentiful harvest of cotton simultaneously with sowing seeds, the application of fertilizers to the soil plays an important role.

To apply 45-60 kg of pure nitrogen per hectare, 150-200 kg of ammonium nitrate will be required. However, using 900-1200 kg of dried biomass of higher plants instead of such a quantity of chemical fertilizers, we will be able not only to meet the need of plants for nitrogen, but also to enrich the organic composition of the earth without compromising the micro- and macrofauna of the soil. The most important thing is that the biofertilizer prepared in this way is environmentally friendly and cost-effective, and it does not require any production capacity, and also does not have a negative impact on the ecological state of the atmosphere, soil and water.

IV. CONCLUSION

1. Higher aquatic plants are considered the main producers of organisms in the aquatic biocenosis and are the basis of the food chain for many other organisms. They have a significant impact on soil chemistry and light levels, as they trap pollutants and sediments, slowing down the flow of water.

2. Being an invasive plant, higher aquatic plants completely cover the water, prevent the development of weeds and, after dying off, enrich the soil of cultivated lands with nitrogen. Thus, the use of mineral fertilizers can be avoided, since chemical fertilizers, in addition to being expensive, accumulate in the soil and pollute groundwater.

3. Currently, the pollution of existing water resources is one of the global problems on earth, including in our country. Therefore, one of the important tasks is to study effective methods of neutralization and purification of polluted waters, as well as the use of biomass of higher aquatic plants grown at sewage treatment plants to obtain unconventional energy sources (biogas, bioethanol) and biofertilizers.

4. Higher aquatic plants do not require special conditions for reproduction and formation of biomass and easily propagate vegetatively, forming a sufficient amount of biomass. Plants with a small vegetative body, such as azolla and ryaska, produce 250-300 g, and pistia and eichornia-1 kg/m2 or more of biomass per day.

5. Biofertilizer, prepared from higher aquatic plants, has a useful mineral composition for agricultural crops, is environmentally friendly and cost-effective.

6. Biofertilizers prepared from higher aquatic plants are much more effective than conventional organic fertilizers and are able to provide the plant with sufficient moisture, as well as minerals.

7. The cost of harvesting from plants also depends on the costs of mineral fertilizers spent on their cultivation, and therefore the main attention should be paid to fertilizing crops with affordable and high-quality natural fertilizers. Of particular importance in this regard are biofertilizers, which positively affect the development of the plant without any damage to the macro- and microfauna of the soil.

8. In terms of mineral composition, biofertilizers are not inferior to mineral and other organic fertilizers, and by growing a tall aquatic plant for the purpose of preparing biofertilizers, simultaneous purification of the reservoir from various pollutants is achieved.

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