TESTING OF PHYTOMELIORATED DARK – GRAY SCHIST CLAY PROFILE WITH MISCANTHUS

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Renewable energy, especially from perennial grasses, can significantly affect the processes of solving global problems in the field of energy security. Among the extensive list of plants that can be used as energy crops, the most preferable are those that do not require intensive cultivation technologies, are unpretentious to environmental conditions and yield large harvests even on marginal, contaminated and disturbed soils. A promising plant in this regard can be miscanthus.

To study the potential of this crop when growing on marginal and disturbed soils a field experiment was established at Pokrov land reclamation station of Dnipropetrovsk State Agrarian and Economic University. The main attention was focused on the possibility of Miscanthus × giganteus growing on dark-gray schist clay (DGSC). Rhizomes of miscanthus were planted in lysimeters with geochemically active DGSC. The clay was taken from the experimental plot, which is in the stage of natural overgrowing for four decades. The required amount of rock was selected in three strata: 0–20 cm, 20–40 cm and 40–60 cm and has been poured into the lysimetric containers with a layer of 60 cm. Sand was used as underlying substrate. Morphometric parameters, biomass productivity and content of microelements in plant samples were studied.

Unlike other rocks dark-gray schist clay contains up to 1% pyrite. As a result of its oxidation in the presence of water the ferrous form of iron and sulfuric acid are formed. They, acidifying the soil solution in turn, detrimentally affect growth and development of plants. Similarly, sulfur oxide is harmful, which is a consequence from the pyrite oxidation without access of water. These chemical processes are accompanied by the release of heat, causing the dryness of rocks and scant content of organic matter. Thus, these rocks are harmful for most crops and without preliminary melioration unsuitable for their growth. On the territory of Pokrov reclamation station the piling of this clay onto the earth's surface took place about 50 years ago. So this substrate was under the influence of chemical and biological weathering. Data on pH (6.2–7.5) and electrical conductivity (90–1840 μS/cm) show that the dark-gray schist clay in the aeration zone is still under the influence of oxidation-reduction processes. At a depth of 20-60 cm, pH varies from slightly alkaline to slightly acidic. The lower layers are more salty. Such unfavorable factors affected the growth and development of miscanthus. Maximum height of plants in the first year of cultivation did not exceed 125–130 cm. The best values were noted for plants grown on the stratum 40–60 cm, the worst on the stratum 20–40 cm. The intensity of monocarpic shoot formation was also low and by the end of the year varied from 4 (stratum 0–20 cm) to 9 shoots per plant (stratum 20-40 cm). As a result, the productivity of dry biomass was small. The average dry weight of one plant grown on 20–40 cm and a 40–60 cm strata was almost identical – 201.8 and 213.4 g respectively. Plant productivity on the 0-20 cm stratum was significantly lower – 143.6 g. Accordingly in the first year Miscanthus × giganteus is able to produce a yield from 2 to 3 tons per hectare on dark-gray schist clay.

The content of microelements in the aboveground biomass of Miscanthus was as follows: for Zn 19.89-13.26 μg/g, Cu 3.21-1.91, Fe 369.86-134.45, Mn 30.53-15.38, Pb 2.71-1.67 μg/g. The relatively small content of trace elements in the above-ground mass can be explained by the effect of preferential accumulation of heavy metals in the roots.

Thus, the ability of Miscanthus plants to produce a stable yield and a small accumulation of heavy metals in the above-ground biomass suggests the prospects of this energy crop cultivation on phytomeliorated mining rocks.

Key words: Dark – Gray Schist Clay, Soil Profile, Phytomelioration, Miscanthus