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THE POSSIBILITY OF MISCANTHUS X GIGANTEUS GROWING AS A BIOFUEL CROP ON CONTAMINATED MILITARY SITES

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In order to establish the possibility of Miscanthus *x* Giganteus growing as a biofuel crop on contaminated military sites and for its phytoremediation we initiated investigations on the territory of former military unit located in the city of Dolyna, Ivano-Frankivsk region (Ukraine). For this purpose, 480 rhizomes of the miscanthus were planted on three experimental sites with a total area of 268 m^2. For the analysis of soil contamination 50 soil samples were selected from all experimental sites at depths up to 15 cm. The quality of biomass was checked by determination of ash content after burning of roots, stems and leaves of Miscanthus *x* Giganteus and content of pollutants in the ash. All samples of soil and biomass were prepared for the analysis in accordance to EPA 6200.

Phytoremediation is a proven technique for recovery of contaminated soils. The approach was born from the observation that plants possess physiological properties useful for environmental remediation. Phytoremediation is inexpensive and ecologically friendly, effective for large areas with moderate concentrations of contaminants and it has a good potential for cleaning brown-fields and contaminated sites. A growing number of research projects are examining the union of two processes, i.e. phytoremediation with synchronized production of biofuel crops. The main reason is the possibility of restoring marginal land to agricultural food crop use and fulfilling the growing demand for biomass as an alternative energy source. Second generation biofuel crops are becoming favored because they are not in competition with main agricultural food crop production.

According to the results of X-ray fluorescence analysis of soil samples (ElvaX Light SDD, “Elvatech”), the tolerance value was exceeded for 13 elements, some of which belong to different classes of danger: Zn, Pb, As – first class of danger; Co, Ni, Mo, Cu, Cr – second class of danger; V, Mn, Sr – third class of danger. Also, were established a slight excess of Ti and Fe. In that reason the total pollution index Z_c was calculated for the analyzed samples which is defined as an additive sum of exceeding coefficients of elements concentrations over the tolerance value, and Z_c was equal 19.61, which means that in terms of contamination state and impact to the environment and human health in accordance with standard the soil was classified as “slightly dangerous”.

The X-ray fluorescence analysis of ashes samples of biomass (roots, stems and leaves) also showed the presence of determined in soil samples elements, but in a smaller amount. To determine the intensity of absorption of macro- and trace elements by plants, their Biological Accumulation Coefficients (BAC) were also calculated. The BAC is an empirical indicator, which is a measure of the redistribution of pollutants between the plant organism and the soil, is determined as the ratio of the content of metals in the plant to their content in the soil. It`s value for Ti, V, Cr, Fe, Co, Ni, As and Pb didn`t exceed the value of 0.05 in all biomass samples. But for Mn in stems and leaves, Zn in stems, Sr and Mo in leaves the value of BAC were close to 2.0, which indicates a high level of biological absorption by that parts of plants due to the large concentration of mobile forms of these elements. The ash content of roots, stems and leaves biomass samples was 5.0, 4.4 and 7.1 %, respectively.

The productivity of biomass was calculated, based on the results of plants height measurements, their number and mass. Calculated output energy varied from 2.7 to 4.5 GJ/ha at it combustion.

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