

PLANTS FOR PHYTOREMEDIATION AND BIOFUEL PRODUCTION

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Today decontamination of heavy metal polluted soils is a very important problem in Ukraine. Soils are always contaminated by pollutants, pesticide remains and heavy metals. Soil contamination is a result of functioning mining, metallurgy and chemical industry plants as well as non-rational application of chemical means of plant protection in agriculture. The range of such preparations as well as the areas of contaminated soils increase every year. That is why it is necessary to study innovative techniques of soil decontamination from heavy metals and their compounds. Phytoremediation with the help of plants is one of the most efficient decontamination techniques.

Rape, sugar beet, hemp, goosefoot, wild cereals, brown mustard (*Brassica juncea*) are widely used plants in phytoremediation in Ukraine. However, we believe that this list of plants should be supplemented with new plants taking into account uptake capability of their root system. Energy crops which quickly form strong root system and above-ground vegetative mass, have perennial life cycle, high coefficient of bioaccumulation, simple cultivation and phytomass harvesting technology can be new and important plants for phytoremediation.

Previous studies have shown that a combination of soil recultivation using fast-growing, woody energy crops with further energy utilization is successful and profitable. It is reasonable to use such woody energy crops as willow and poplar as well as grassy plants like sorghum, silver grass (*Miscanthus*) and switchgrass.

The research aim is to determine the uptake ability of plants which are capable to accumulate heavy metals and can be used for biofuel production. The research task is to establish the peculiarities of heavy metal accumulation in phytomass of energy crops as well as the use of these crops for energy purposes.

A field experiment with energy crops and their phytoremediation characteristics has been conducted according to general and special methodology. The experiment has been conducted on the soils of the central forest-steppe contaminated by heavy metals of different concentrations.

On average during three years of the experiment cadmium was characterized by the highest transition coefficient from the soil into energy crops plants. Transition coefficient of cadmium (K) in total phytomass was more than 0.5. Cobalt was characterized by the least transition coefficient, it was less than 0.1. Copper transition coefficient (K) was at the level of 0.5; transition coefficient of zinc and lead was less than 0.5.

Silver grass (*Miscanthus giganteus*) provides higher yield than switchgrass (*Panicum virgatum* L), though switchgrass has less dry matter content, higher accumulation of heavy metals in plant phytomass and maximum permissible concentration is lower than regulated standards. Phytomass of these crops can be used as a raw material for production of pollution-free biofuel.

Switchgrass and silver grass are the plants for phytoremediation which have the greatest ability to take up heavy metals. They are these species really classical hyperaccumulators like. These crops intensively take up heavy metals and partially accumulate them in the underground and above-ground parts. Content of heavy metals does not cause substantial plant morphological changes and does not suppress the uptake of heavy metals. Dense, fibrous root system of switchgrass and silver grass helps to extract pollutants from the soil without significant worsening of biomass quality. Having completed vegetation period, above-ground vegetative mass of plants can be properly processed, that is an additional source of non-ferrous metals and biofuel production.

Successful combination of phytoremediation with expanding of land areas under energy crops such as switchgrass, silver grass and others can ensure an efficient decontamination of polluted soils and obtaining biofuel. This combination facilitates increase of energy independence of our country and improvement of environment.

Key words: Phytoremediation, Heavy Metal Accumulation, Phytomass, Energy Crops