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JOINT EVENT

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Phytoremediation potential of two energy grasses in soil contaminated with copper, nickel and zinc

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Using energy grasses for the phytoremediation could be a profitable solution. The cultivation of these plants on polluted areas could serve both for the remediation and for the production of biomass. Hence, it is important to identify the tolerance of the most common energy grasses to the excess of heavy metals in the soil and to investigate the transfer of metals from the roots to the aboveground organs. Among the grasses, the species such as Miscanthus and Spartina are considered the most promising for renewable energy and phytoremediation purposes. The aim of this work was to assess the suitability of Miscanthus×giganteus and *Spartina pectinata* to Cu, Ni and Zn phytoremediation. A 2-year microplot experiment with the tested grasses growing on metal-contaminated soil was carried out. Microplots with cement borders, measuring 1x1x1m, were filled with Haplic Luvisols soil. Simulated soil contamination with Cu, Ni and Zn was introduced in the following doses in mg kg-1: 0- no metals, Cu1-100, Cu2-200, Cu3-400, Ni1-60, Ni2-100, Ni3-240, Zn1- 300, Zn2-600, Zn3-1200. The phytoremediation potential of grasses was evaluated using a tolerance index (TI), bioaccumulation factor (BF), bio-concentration factor (BCF) and translocation factor (TF). *S. pectinata* showed a higher tolerance to soil contamination with Cu, Ni and Zn compared to M. × giganteus. *S. pectinata* was found to have a high suitability for phytostabilization of Zn, and lower suitability of Cu and Ni. M.×giganteus had a lower phytostabilization potential than *S. pectinata.* The suitability of both grasses for Zn phytoextraction depended on age of the plants. Both grasses were not suitable for Cu and Ni phytoextraction. The research showed that one-season studies were not valuable for fully assessing the phytoremediation potential of perennial plants.

Tolerance index - the mean from 3 doses

Metal	Year	Aboveground organs		Belowground organs	
		S. pectinata	M.×giganteus	S. pectinata	M.×giganteus
Cu	2009	53	41	-	-
	2010	73	66	88	74
Ni	2009	67	51	-	-
	2010	88	39	71	47
Zn	2009	66	27	-	-
	2010	77	35	80	47

Bioaccumulation (BF), bioconcentration (BCF) and translocation factor (TF) of metals on Cu, Ni, and Zn contaminated soils

Treatment	BF-2009		BF-2010		BCF-2010		TF-2010	
	SPA	MIS	SPA	MIS	SPA	MIS	SPA	MIS
Cu1	0.00	0.02	0.03	0.01	0.07	0.08	0.29	0.19
Cu2	0.01	0.02	0.02	0.01	0.08	0.07	0.21	0.14
Cu3	0.01	0.02	0.01	0.01	0.06	0.06	0.21	0.10
Ni1	0.06	0.07	0.30	0.06	0.23	0.37	0.13	0.14
Ni2	0.07	0.06	0.54	0.55	0.46	0.30	0.09	0.17
Ni3	0.11	0.16	0.56	0.50	0.48	0.19	0.11	0.24
Zn1	0.26	0.88	0.32	0.22	1.01	0.73	0.48	0.29
Zn2	0.44	1.39	0.88	0.35	1.38	0.58	0.60	0.38
Zn3	1.26	1.68	1.33	0.44	1.83	1.28	0.73	0.33

SPA – S. pectinata, MIS – M.×giganteus

Recent Publications

1. Li C, Xiao B, Wang Q H, Yao S H and Wu J Y (2014) Phytoremediation of Zn- and Cr-contaminated soil using two promising energy grasses. Water Air Soil Pollut 225(7):2027.
2. Korzeniowska J and Stanislawska-Glubiak E (2019) Phytoremediation potential of *Phalaris arundinacea, Salix viminalis* and *Zea mays* for nickel-contaminated soils. Int J Environ Sci Technol. 16(4):1999-2008.
3. Korzeniowska J, Stanislawska-Glubiak E and Igras J (2011) Applicability of energy crops for metal phytostabilization of soils moderately contaminated with copper, nickel and zinc. J Food Agric Environ 9(3-4):693-697.

4. Redondo-Gómez S (2013) Bioaccumulation of heavy metals in Spartina. Funct Plant Biol 40(9):913-921.
5. Stanislawska-Glubiak E, Korzeniowska J and Kocon A (2014) Effect of peat on the accumulation and translocation of heavy metals by maize grown in contaminated soils. Environ Sci Pollut Res. 22(6):4706-14

Biography

Jolanta Korzeniowska works for the Institute of Soil Science and Plant Cultivation–National Research Institute in the position of a Professor. Her research area covers plant response to heavy metals, as well as the methods of the reduction of phytoavailability of those metals from contaminated soils. She also does research on making use of waste materials in agriculture and in soil remediation. Moreover, her field of research covers searching the reliable assessment methods of micronutrient concentration in the soil for fertilization purposes, as well as recommendations for micronutrient fertilization, determination of new mineral fertilizers composition and testing their efficiency. Being the author of about 150 original scientific publications, she has also has number of publications.

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