



DETAILED STUDY OF Cs-137 ACCUMULATION IN POTATOES GROWING ON RADIOACTIVELY CONTAMINATED POST-CHERNOBYL LAND

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The Chernobyl radioactive accident in 1986 was yet considerable accident in agriculture of affected lands, which extended to more than 2.7 million hectares in Russia. One of the most contaminated areas of arable chernozems have been formed in Tula region and received the name “Plavsky radioactive hotspot”. Initial levels of Cs-137 in soils of the area exceeded radiation safety standard by 5-15 times and has reached up to 555 kBq/m². Nevertheless due to great fertility of chernozems of the “Plavsky radioactive hotspot” it was decided to continue agricultural land use with strict control of Cs-137 in vegetable production. So obtaining ecologically acceptable and safe crop yields was the main agricultural problem of the area.

Potatoes is one of the major agricultural crop in cultivated lands of the “Plavsky radioactive hotspot”, which is widely grown for commercial purposes as well as commonly used in the diet of local population. To inspect current level of Cs-137 accumulation in potatoes cultivated at the central part of radioactively contaminated area taking into account all parts of the crop – shoots, roots, and tubers – a study at a central part of the “Plavsky radioactive hotspot” was conducted.

The level of Cs-137 contamination of arable chernozem is 154 ± 30 kBq/m² (408 ± 19 Bq/kg), i.e. still 4 times exceeds standard of safety. Whereas Cs-137 activities in biomass of potatoes are one-two orders of magnitude less: the average activity of Cs-137 in aerial parts is 20 ± 7 Bq/kg, roots – 6 ± 0.8 Bq/kg, and tubers – 5 ± 0.4 Bq/kg. So, transfer factor values (TF, the ratio of Cs-137 activities in vegetation and in soil) not exceed 0.1 for all potatoes parts that accords well with the generalized data of IAEA (2010).

The bulk of Cs-137 is accumulated in shoots of potatoes (TF 0.05), while the radionuclide incorporation into underground parts (tubers and roots) is 4 times less (TF 0.01). As this takes place, the flesh of tubers is characterized by higher TF values (0.008) compared to potato peels (0.004). Consequently, the accumulation of Cs-137 occurs within tissues, but not on the surface of tubers. Total amount of Cs-137 in potatoes biomass seems to be mostly affected by the process of the radionuclide root uptake, and only negligible by diffusion from contaminated soil into underground parts. Probably, the distinction in the levels of the radionuclide content in flesh of potato tubers and peels could be determined by different amount of cell's water. Indeed, the accumulation of Cs-137 in potatoes tuber juice (TF 0.006) and starch grains (0.005) is found to be more than in presscake (0.002).

Thus, after 30 years after the Chernobyl accident, arable chernozems of “Plavsky radioactive hotspot” are still polluted. However, the transfer of Cs-137 from soil to the potatoes tubers and other crop's components is strongly discriminated. Root uptake of Cs-137 by potatoes is not intensive and current levels of the radionuclide accumulation in tubers are in complete agreement with human sanitary-hygienic requirements. Therefore, the radiation dose receiving by people through potato consumption is acceptably small.