Seasonal variation of roe deers meet contamination by radiocaesium at the Ukrainian Polesie

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Introduction

Radionuclides transfer from soil to man on food chain: soil—plant—game animal. It is important pathway for radionuclide transfer to man (Sokolov *et al.* 1987). The transfer of radionuclides to game animals reflect the integrated behaviour of the radionuclide within the whole range of the game animal.

The ecological effects of half lives izotops as for ^{137}Cs in the forest ecosystem as were studied by radiocaesium levels in food products such as moose and roe deer meat are very long and were suggested to be similar as their physical half life (Johanson and Bergström 1991). The combination of high soil-plant transfer and long effective ecological half life of ^{137}Cs in the forest ecosystem will therefore result in high collective dose contamination due to transfer by game animals.

The aim of the present study was to find transfer parameters of radiocaesium to meet of roe deer depending on season and to important fodder plants for this game animals.

Materials and methods

The study area in Ukraine is located in the Ovruch districts of Zhitomir region located about 70 km West of the nuclear plant in Chernobyl. The mean ground deposition of ^{137}Cs was 260 with a range of 30 to 980 $kBq \cdot m^{-2}$. During 1992 - 1993 muscle samples from harvested roe deer were collected in this area. Soil samples were taken from the upper 0 - 10 cm layer of soil in same area. Samples of roe deer's diet were collected around the same site as the soil sampling. Rumen content of killed roe deer were also collected and used for botanical analysis

^{137}Cs activity concentration in the samples were determined by gamma spectrometer systems using either high purity Ge detectors at the Department of Radioecology, Uppsala, Sweden or using a NaI(Tl) crystall detector at the State Agroecological Academy (Zhitomir).

Transfer coefficient was calculated by dividing ^{137}Cs activity concentration in plant or meat ($Bq \cdot kg^{-1}$) on ^{137}Cs ground deposition ($kBq \cdot m^{-2}$).The rumen content

were sieved on a 2 mm net and from the unsieved fraction the pieces of the various species were separated, dried and the weight were determined. The results were expressed as area fraction.

Results

The highest activity concentrations of ^{137}Cs were found in birch, bilberry and *Molinia caerulea* with 28 000 $Bq \cdot kg^{-1}$, 23 000 and 22 000 respectively (Table 1). ^{137}Cs activity concentration below 1 000 $Bq \cdot kg^{-1}$ was found in Salix cinerea with mean level 960 $Bq \cdot kg^{-1}$. The corresponding transfer coefficients were 121 $m^2 \cdot kg^{-1}$ for birch, 137 for *Molinia caerulea* and between 47 and 118 for most of the Ericoid dwarf shrubs such as bilberry, lingonberry, whortleberry (*Vaccinum uliginosum*), and heather. Most of the trees except birch had rather low transfer coefficients - from 14 for willow (*Salix sp.*) to 71 for mountain ash (*Sorbus aquparia*).

As to Ukrainian forest ^{137}Cs activity concentration in various species of mushrooms were higher than for vascular plants (Table 1). The highest mean ^{137}Cs activity concentration was found in *Paxillus involutus* with a mean level of 286 000 $Bq \cdot kg^{-1}$ growing on soil with a range of ground deposition from 67 to 313 $kBq \cdot m^{-2}$. Even *Xerocomus badius, Cantharellus cibarius, Boletus edulis* and *Russula flava* show activity concentrations higher than the plant species. The transfer coefficients for five species of fungi are shown in Table 1. *Paxillus involutus* show a transfer coefficient of 2 200 and *Xerocomus badius* 843 $m^2 \cdot kg^{-1}$.

The ^{137}Cs activity concentrations in 16 samples of roe deer muscles are shown in Table 2. As can be seen, mean peak values of 13 000 and 17 500 $Bq \cdot kg^{-1}$ occured in August and October respectively during the mushroom season. During other months the ^{137}Cs activity concentrations varied between 1 200 and 3 600 $Bq \cdot kg^{-1}$. The aggregated transfer factors varied from 29 to 45 $m^2 \cdot kg^{-1}$ during the peak values and 16 to 41 during the other months.

The results of botanical analysis of the content of roe deer rumen discovered that the main components of roe deer diet in summer and autumn period are leaves of mountain ash and aspen. Some mushroom was also found in the roe deer rumen content during the period July to September. Altogether 22 species of plant and mushroom were found in rumen content of roe deer.

Conclusion

Established conformity to natural laws of transfer radiocaesium to elements of roe deer's diet and its meet permit to plan of animals slaughtering period on the basis of density contamination of soil by radiocaesium and specific season.

References

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Table 1. ^{137}Cs ground depositions and activiti concentrations in elements of roe deer's diet.

Species	Ground deposition, $kBq \cdot m^{-2}$				Activiti, $kBq \cdot kg^{-1}$		TF, $m^2 \cdot kg^{-1}$
Betula pubescens	51	505	231	46	27.9	1.7	121
Populus tremula	51	505	222	70	12.6	1.3	57
Sorbus auquparia	46	463	116	44	8.2	3.1	71
Salix cinerea	51	84	66	4	0.9	0.2	14
Molinia raerulea	46	466	160	34	22.0	7.0	137
Vaccinium myrtillus	30	900	258	26	23.0	3.0	89
Calluna vulgaris	46	313	178	77	13.0	0.7	73
Vaccinium uliginosum	48	505	168	12	7.9	0.7	47
Vaccinium vitis-idaea	52	505	228	70	27.0	9.0	118
Agrostis sp.	52	505	340	44	17.0	6.0	50
Elytrigia repens	56	615	208	40	0.3	0.1	1
Paxillus involutus	67	313	130	46	286	1	2200
Xerocomus bodius	67	176	121	14	102	16	843
Boletus edulus	53	117	97	2	25	3	258
Russula flava	67	80	71	4	47	9	662

Table 2. ^{137}Cs activity concentrations in roe deer meat and transfer factors during 1992-1994

Monhts	1992		1993		1994	
	$Bq \cdot kg^{-1}$	TF	$Bq \cdot kg^{-1}$	TF	$Bq \cdot kg^{-1}$	TF
February	3626*	21	2655*	26	4229	25
April					3894	17
May			3088	29	3985	27
June	1244	16	1904*	19		
July					10334	41
August	3044	44	13078	39		
September	3268*	40	3068	42	11783	45
Oktober	17544	29				
December			7585	30		