

Ionizing radiation from Chernobyl affects development of wild carrot plants

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Table S1. Results from hand dosimeter substrate measures and gamma dosimetry soil, plant and root measurements.

	Mean	SD
Substrate radiation $\mu\text{Sv/h}$	5.64	7.55
Soil radionuclide exposure Bq/kg	23296.24	28691.02
Plant radionuclide accumulation Bq/kg	730.08	971.68
Root radionuclide accumulation Bq/kg	1480.67	2068.41

Table S2. Ionizing radiation in the location of maternal plant collection and the number of germinated seeds per plant.

Maternal plant	Radiation ($\mu\text{Gy/h}$)	Germinated seeds
1	6.10	1
2	3.60	2
3	3.44	17
4	5.39	14
5	4.42	0
6	0.50	11
7	0.50	15
8	0.50	18
9	0.51	20
10	0.40	15
11	0.30	19
12	0.30	14
13	0.30	19
16	21.40	18
17	21.63	16
18	25.78	6
19	28.30	12
20	30.20	15
21	0.17	19
22	0.16	17
23	0.19	17
24	0.17	20
25	0.17	19
26	0.67	18
27	1.02	20
28	1.10	18
29	1.05	19
30	0.50	16
31	0.14	20
32	0.10	20
33	0.08	18
34	0.15	13
35	0.14	17

Table S3. Mixed model results (based on Laplace approximation) of the effects of ionizing radioactive contamination and seed mass (and earlier stages of development) on various subsequent developmental stages of wild carrots collected as seeds from the Chernobyl Exclusion Zone and grown in a greenhouse. Reduced results are presented in Table 1. The significance levels of effects were estimated with log likelihood ratio test (pLLRT).

Dependent variables	Model Log-Likelihood	Effect	Estimate	SE	value	pLLRT
Germination	-273.3	Radiation	-1.2321	0.001	-949.7	0.0019
Germination time	-1436.1	Radiation	0.0773	0.023	3.37	0.0011
		Seed mass	0.2867	0.129	2.22	0.026
Cotyledon emergence	-1111.3	Germ. time	1.9236	0.0257	74.85	<.00001
		Radiation	0.0124	0.007	1.68	0.094
		Seed mass	0.0777	0.043	1.81	0.080
1 st leaf emergence	-969.6	Germ. time	-1.2934	0.422	-3.06	NA
		Cotyledon	2.5703	0.383	6.72	NA
		Seed mass	0.2842	0.284	1.00	NA
		Germ.* Mass	-1.5877	0.419	-3.79	0.0003**
		Cot.* Mass	1.0665	0.385	2.77	0.0091
2 nd leaf emergence	-917.3	1 st leaf	-0.0056	0.416	-0.01	NA
		Cotyledon	1.8946	0.372	5.10	NA
		Germination	0.1023	0.050	2.04	NA
		Radiation	0.2066	0.057	3.59	NA
		Seed mass	0.1730	0.277	0.63	NA
		1 st l. * Rad.	-0.3069	0.061	-5.00	<.00001***
		1 st l. * Mass	-1.5246	0.398	-3.84	0.0109
		Cot.* Mass	1.5658	0.360	4.35	0.0024*
		Germ.* Rad.	1.1183	0.058	2.03	0.0437
		Mass * Rad.	-0.0591	0.025	-2.36	0.0215
3 rd leaf emergence	-926.3	Germ. time	0.1082	0.043	2.50	0.0132
		1 st leaf	0.4490	0.083	5.43	<.00001***
		2 nd leaf	1.3824	0.084	16.43	<.00001***
4 th leaf emergence	-881.2	1 st leaf	-0.0214	0.068	-0.31	NA
		2 nd leaf	0.2325	0.085	2.73	NA
		3 rd leaf	1.9047	0.090	21.25	<.00001***
		Radiation	-0.0813	0.075	-1.08	NA
		1 st l. * Rad.	-0.2135	0.082	-2.59	0.011
		2 nd l. * Rad.	0.2486	0.087	2.84	0.005*
5 th leaf emergence	-890.9	3 rd leaf	0.6107	0.099	6.17	<.00001***
		4 th leaf	1.6724	0.098	17.02	<.00001***
		Radiation	-0.0077	0.003	-2.67	0.0076*
6 th leaf emergence	-802.0	1 st leaf	-0.1867	0.066	-2.82	NA

		4 th leaf	0.3833	0.131	2.92	0.0090
		5 th leaf	1.7129	0.119	14.35	<.00001***
		Radiation	-0.3048	0.087	-3.50	NA
		1 st l. * Rad.	0.2355	0.069	3.44	0.0007**
7 th leaf emergence	-433.1	3 rd leaf	-0.1063	0.119	-0.89	NA
		6 th leaf	3.0479	0.249	12.24	NA
		Radiation	-0.4946	0.179	-2.76	NA
		Seed mass	-2.5465	0.386	-6.60	NA
		3 rd l. * Rad.	0.3349	0.123	2.72	0.0098
		6 th l. * Mass	1.5454	0.236	6.55	0.0266

Values - "z" for Germination model assuming logit link function, "t" for the rest of the models assuming log link function. NA - part of higher-order interaction, LLRT skipping term. Terms significant after applying Bonferroni correction for multiple separate tests for 7 leaves: *** <.00001, ** .00001-0.01, * 0.01-0.05.

Supplementary Figure:

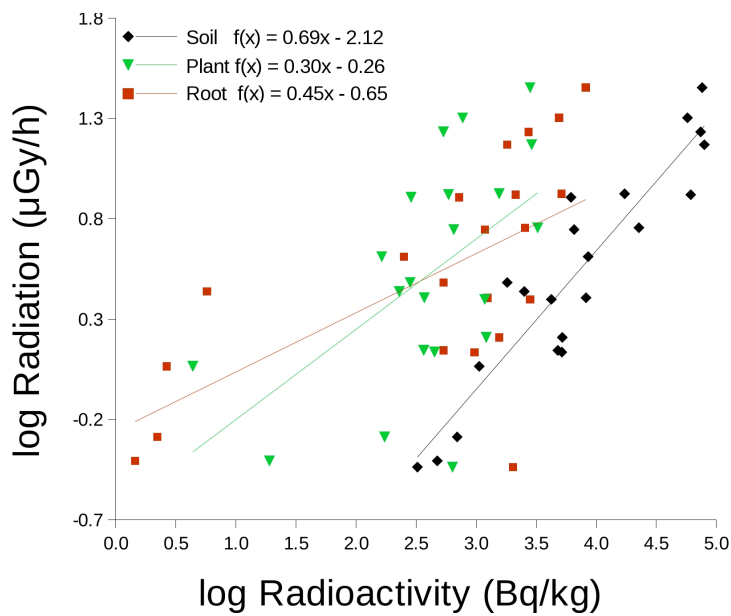


Figure S1. Correlations between hand-held dosimeter measures (log transformed, Radiation) and soil, plant (above ground parts) and root radioactive dose exposure and uptake in carrots (log transformed, Radioactivity).