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Absorption of cs-134 of Soya */Glicine/* Cultivars Grown on Two Soil Types

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Abstract: Vessel vegetation experiments were carried out with three soya cultivars spread in Bulgaria during the period of study. The plants were grown on two soil types characteristic of the country - izlujen chernozem /black earth/ and kaneleno podzolista /maroon soil/, contaminated with the radionuclide Cs-134.

It was established that the radiocesium is unevenly accumulated in the different plant parts - its greatest amount being in the leaves, and smallest in the seeds. The amount of radiocesium accumulated in the above-the-soil parts of plants grown on kaneleno podzolista /maroon soil/ is from six to ten times as that in the plants grown on izlujen chernozem /black earth/.

Cultivar differences in the absorption of the radionuclide were recorded - the amount of Cs-134 accumulated in cultivar Pavlikeni 121 is twice as that in cultivars Hodzon and S-1346.

Key words: accumulation of Cs-134, cultivar differences, soya plants, soil types.

Introduction

When we prognosticate the accumulation of radionuclides in the agricultural crops under the conditions of radioactive soil contamination it is necessary that we trace the radionuclide migration /Guliakin at all,1962; Prister at

all, 1991/, the influence of the soil type /Alexahin, 1963/, the crop type and the cultivar differences / Lambrecht, 1956/.

The aim of the current research was to study the basic regularities in the behaviour of the radionuclide Cs-134 in its transfer from the different soil types to the basic soya cultivars spread in Bulgaria.

Material and Methods

Vessel vegetative experiments under controlled conditions were carried out with two representative of the country soil types provided by the experimental fields of Research Inst. of Soil Anayisis "N.Pushkarov"- izlujen chernozem (black earth) experimental field Gorni Dubnik, Pleven Region, and kaneleno podzolista (maroon soil) - experimental field Primorsko, Burgas region. The agrochemical characteristics of the studied soils are shown in Table 1.

Tab. 1. Agrochemical characteristics of the investigated soils.

Soil type	pH KCl	Humus %	Ca meq/100g soil exchange	K_2O mg/100g soil	Sorption capacity $T_{8.2}$/100g soil
Izlujen chernozem, G,Dubnik	5.2	3.55	23.99	28.19	33.70
Kaneleno podzolista, Primorsko	3.82	2.72	9.27	20.00	23.10

The experiment was carried out after the following pattern: vessels with capacity of 5 kg soil, four repetitions, contamination of the soil with aqueous solution of Cs-134 with activity of 0.135 MBq/kg soil. Three soya cultivars spread in Bulgaria were studied during the test period: Pavlikeni-121, S-1346 and Hodzon. In each vessel there were placed five normally developed plants, which were grown till the phase of complete ripeness. The epigeous parts of the plants (leaves, stems, capsules, and seeds) were checked with a multi-channel gamma-spectrometer Camberra with a Germanium detector with a 20% effectiveness and a measuring error below 10%.

In order to assess the transfer of the radionuclide from the soil to the different plant organs a "coefficient of accumulation" (CA) was introduced, representing the relationship between the radionuclide activity in 1 g epigeous plant tissue and 1 g soil.

Results and Discussion

The results of the analysis of the studied soya cultivars, grown on izlujen chernozem (black earth) are shown in Table 2. They indicate that there is a greater accumulation of the radionuclide in the vegetative organs, primarily the leaves. The uneven distribution of Cs-134 in the above-the-soil plants organs is evident in all studied cultivars. The lowest accumulation of the radiocesium is

observed in the soya seeds. It is up to 5 times lower than that in the leaves and from 2.5 to 3.5 times lower than that in the stems.

Tab. 2. Accumulation of Cs-134 from different sorts of soya, raised on izlujen chernozem soil .

Sort	Plant organs	Average activity Bq/g	Coefficient of accumulation
Pavlikeni -121	leaves	11.80±0.72	0.09
	stems	6.88±0.43	0.05
	capsules	3.50±0.30	0.02
	seeds	2.80±0.16	0.02
Hodzon	leaves	6.60±0.32	0.05
	stems	4.90±0.34	0.04
	capsules	2.18±0.53	0.01
	seeds	2.00±0.10	0.01
S - 1346	leaves	5.90±0.33	0.04
	stems	4.60±0.43	0.03
	capsules	1.60±0.17	0.01
	seeds	1.60±0.21	0.01

The intracultivar comparisons indicate a more intensive extraction of Cs-134 from cultivar Pavlikeni -121 in comparison with cultivars S-1346 and Hodzon. In this cultivar we have recorded about twice larger values of the accumulation coefficients for all above- the- soil organs (CA = 0.09 for the leaves; 0.05 for the stems; 0.02 for the capsules and the seeds). In cultivars Hodzon and S-1346 no considerable differences were observed regarding the accumulation of the radiocesium in the studied plants.

Analogous results were recorded in the same soya cultivars, grown on kaneleno podzolista (maroon soil) /Table 3/. In this case too, the lowest accumulation of Cs-134 was recorded in the soya seeds. In cultivar Pavlikeni 121 the accumulation of the radionuclide in the seeds is three times lower than that in the leaves, twice lower than that in the stems, and by 28% lower than that in the capsules. In cultivars S-1346 and Hodzon the accumulation of Cs-134 in the seeds is lower than that in the leaves, stems, and capsules - 4 times, twice, and 50%, respectively.

On this soil type too, the intracultivar comparisons indicate that the greatest accumulation of the radiocesium in all above-the-soil organs is in cultivar Pavlikeni-121. The leaves of this cultivar accumulate from 32% to 34% more Cs-134 than the cultivars S-1346 and Hodzon. These differences are from 42% to 47% in the stems, 36% in the capsules, and 44% in the seeds. The highest coefficients of accumulation for the epigeous plant tissue were recorded in cultivar Pavlikeni 121 (CA = 0.59 for the leaves; 0.36 for the stems; 0.25 for the capsules; and 0.18 for the seeds).With regard to the accumulation of the radiocesium, no significant differences were recorded between the cultivars S-1346 and Hodzon. According to

some researchers, the cultivar differences in the accumulation of the radiocesium in the plants can be explained with the genotype only (4).

Tab. 3. Accumulation of Cs-134 from different sorts of soya, raised on kaneleno podzolista soil

Sort	Plant organs	Average activity Bq/g	Coefficient of accumulation
Pavlikeni -121	leaves	79.34±1.77	0.59
	stems	48.14±2.50	0.36
	capsules	33.20±1.28	0.25
	seeds	24.41±1.87	0.18
Hodzon	leaves	55.05±3.90	0.40
	stems	29.12±1.04	0.21
	capsules	21.50±1.36	0.25
	seeds	13.07±1.70	0.09
S - 1346	leaves	52.70±2.84	0.39
	stems	26.16±1.01	0.19
	capsules	20.45±3.20	0.15
	seeds	14.00±1.89	0.10

The comparison of the data in Table 2 and 3 shows that all cultivars grown on kaneleno podzolista (maroon soil) are characterized with a much greater accumulation of Cs-134 than those grown on izlujen chernozem (black earth). These accumulation differences vary from 6 to 10 times, depending on the cultivar and the plant organs.

It is a well-known fact that the soil with its physicochemical characteristics strongly influences the accumulation of radiocesium in the plants (1, 2, 3). The transfer of the radiocesium from the soil to the plants depends to a great extent on the acidity of the soil. Plants, grown on more acid soils /kaneleno podzolista (maroon soil)/ accumulate Cs-134 more intensely. The organic substance also exerts influence on the radionuclide access to the plants. The higher humus content in the izlujen chernozem (black earth) increases the mobility of the radiocesium and reduces its transfer from the soil to the plants. Similar is the influence of the absorption capacity of the soil. The kaneleno podzolista soil (maroon soil) has a lower absorption capacity and gives away greater amount of radiocesium to the plants.

Conclusion

Cs-134 is accumulated unevenly in the different plant organs - its greatest accumulation being in the leaves, and lowest in the seeds.

There are cultivar differences regarding the absorption of the radiocesium by the plants. The accumulation of Cs-134 in cultivar Pavlikeni -121 is twice as that in cultivars S-1346 and Hodzon.

All the studied soya cultivars grown on kaneleno podzolista (maroon soil) accumulate in their above-the-soil organs from 6 to 10 times more Cs-134, in comparison to those grown on izlujen chernozem (black earth).

References

Alexahin P.M. (1963): Radioactivnoe zagraznenie pochvi i rastenii, M.,Isd-vo AN SSSR, from 132 to 138.

Guliakin I.V., E.V. Udinzeva (1962): Radioactivni produkti delenie v pochve i rastenia, M., Gosatomisdat, ftom 276 to 280.

Lambrecht M. (1956): Empfindichkeit und genotypische Kontitution bei Pisum Agric. ort. genet., 14, N 4, from 47 to 53.

Prister B.S., N.A. Lostilov, O.F. Nemez (1991): Osnovi sel.hos. radiologii, Kiev, "Urodzaj", from 471 to 478 .

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APSORPCIJA RADIONUKLIDA Cs-134 OD STRANE NEKIH SORTI SOJE (*Glicine*) GAJENIH NA DVA TIPA ZEMLJIŠTA

-originalni naučni rad-

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Rezime

Tokom istraživanja, izvršeni su ogledi na tri sorte soje uzgajivane u Bugarskoj, uz upotrebu posuda kapaciteta od 5 kg zemljišta za gajenje biljaka do faze potpune zrelosti. Biljke su gajene na dva tipa zemljišta karakteristicna za Bugarsku - na izluženom cernozemu (crnici) i podzolu (smedjem zemljištu) - zagadjena radionuklidom Cs-134.

Utvrdjeno je da se radiocesijum neravnomerno akumulira u razlicitim delovima biljke - najviše u listu, a najmanje u semenu biljke. Kolicina radiocesi-juma koja se akumulira u nadzemnim delovima biljaka gajenih na podzolu (smedjem zemljištu) 6 do 10 puta je veca od one prisutne u biljkama koje se uzgajaju na cernozemu (crnici).

Zabeležene su razlike u apsorpciji radionuklida od strane ispitivanih sorti soje - količina Cs-134 akumulirana u sorti Pavlikeni 121 dva puta je veca od količine u sortama Hodzon i S-1346.