^{85}Sr, ^{103}Ru, ^{134}Cs

Analysis of the Direct Contamination Pathway of ^{85}Sr, ^{103}Ru and ^{134}Cs in Soybean

,   ,   ,   ,   ,

150

^{85}Sr, ^{103}Ru, ^{134}Cs

.

0.93   .

^{85}Sr 4.5×10^{-5} 2.5×10^{-3}, ^{103}Ru

6.0×10^{-5} 2.3×10^{-4}, ^{134}Cs 4.5×10^{-3} 3.0×10^{-1} ^{85}Sr ^{134}Cs   3   ,

^{103}Ru   2   . ^{85}Sr ^{103}Ru

^{134}Cs   2   .

^{85}Sr ^{103}Ru   0.14   15.2%, ^{134}Cs   9.9   41.9%   .

.

Abstract

A solution containing ^{85}Sr, ^{103}Ru and ^{134}Cs was sprayed to the aerial part of the soybean plant in a greenhouse at 6 different times before harvest and the direct contamination pathway of the radionuclide analyzed. Plant interception factor showed little difference among radionuclides. The maximum value was 0.93, which was observed at the middle growth stage. Translocation factors of ^{85}Sr, ^{103}Ru and ^{134}Cs in the soybean seed at harvest were in the range of 4.5×10^{-5} 2.5×10^{-3}, 6.0×10^{-5} 2.3×10^{-4} and 4.5×10^{-3} 3.0×10^{-1}, respectively. They were highest at the 3rd application for ^{85}Sr and ^{134}Cs and at the 2nd application for ^{103}Ru. Translocation factors of ^{85}Sr and ^{103}Ru in the soybean shell tended to increase with decreasing time interval between application and harvest but that of ^{134}Cs was highest at the 2nd application. The fractions of the initial deposition that remained in the soybean plant at harvest were in the range of 0.14   15.2% for ^{85}Sr and ^{103}Ru, 9.9   41.9% for ^{134}Cs. These results can be utilized for predicting the radionuclide concentration in mature soybean plant and deciding counter-measures when an accidental deposition of the radionuclides occurs during the growing season of soybean.

1.

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(food chain)

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[1 3)].

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. 1950 [4 6)]

[7)] ,

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^{85}Sr, ^{103}Ru, ^{134}Cs

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2.

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2000 5 25 . , ,

60cm, 60cm, 100cm 1.3m

. 2 4 .

2 3 .

.

. RI

^{85}Sr, ^{103}Ru, ^{134}Cs 0.005M HCl (2000 10 2

ml 37.6, 37.7, 6.1 KBq) .

, , 90cm, 90cm, 130cm

. 50~

80cm 1 31 , 14 19ml, 15 .

6 19 , 7 10 , 7 28 , 8 14 , 8 29 , 9 15 (105 , 84 , 66

, 49 , 34 , 17) .

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3 3 5

5.4 7.2 30cm . 5 (8 29)

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3 4 2

. 2 10 2 .

3 , , , .

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Ge ã-spectrometry .

hardware software EG&G ORTEC 0.5 2 .

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(I)

. 3 2 2

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$$I = \frac{(Bq)}{(Bq)}$$

(T)

.

$$R = \frac{\text{(Bq/plant)}}{\text{(Bq/plant)}}$$

(R, %)

.

$$T = \frac{\text{(Bq/plant)}}{\text{(Bq/plant)}} \times 100$$

3.

^{85}Sr, ^{103}Ru, ^{134}Cs   (

)   1

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.

.   0.93   .

2   .

0.1 kg-dry/m^2 0.8~0.9   .
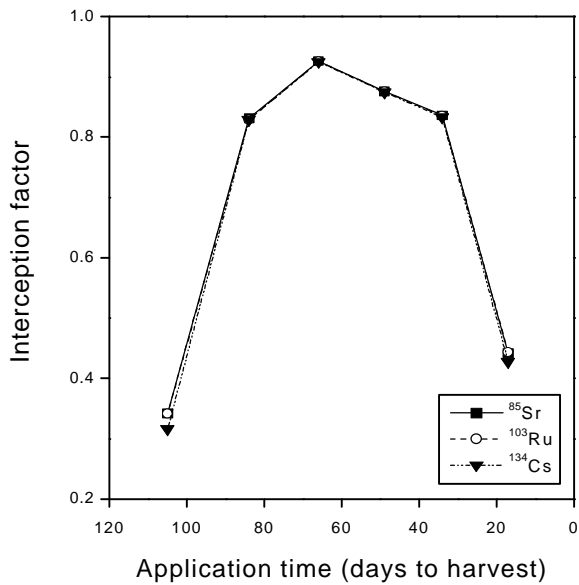
Fig. 1. Interception factors of the radionuclides by
the soybean plant at different growth stages.
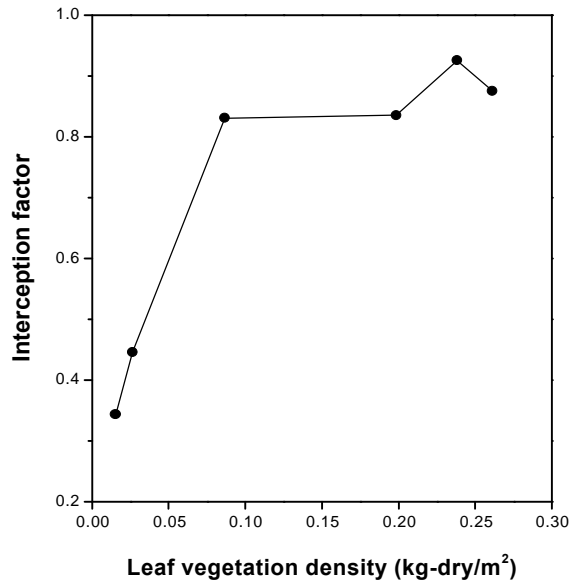
Fig. 2. Relationship between leaf vegetation
density and interception factor in the
soybean plant.
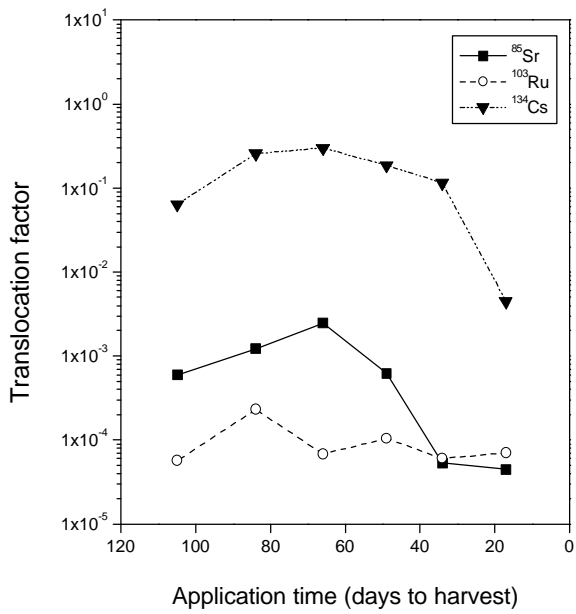
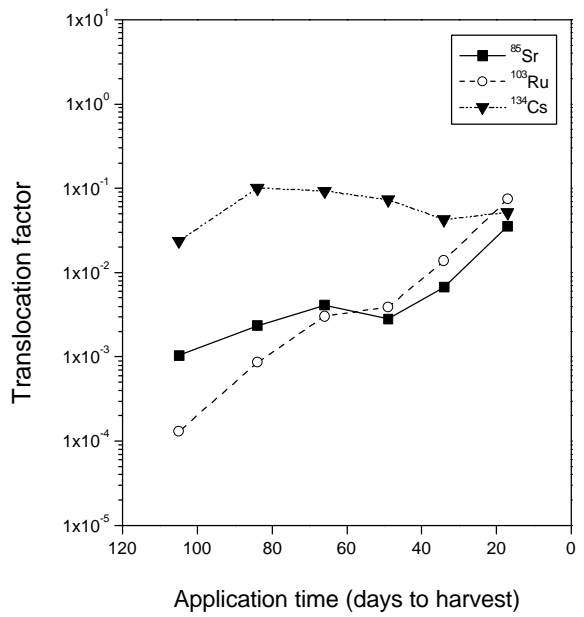Fig. 3. Translocation factors of the radionuclides in the soybean seed at harvest

Fig. 4. Translocation factors of the radionuclides in the soybean shell at harvest

$^{85}Sr,\ ^{103}Ru,\ ^{134}Cs$　　　　　　　　　(

　　　　　　　)　　　　　　　　　$4.5\times\ 10^{-5}$　$2.5\times\ 10^{-3},\ 6.0\times\ 10^{-5}$　$2.3\times\ 10^{-4},\ 4.5\times\ 10^{-3}$　$3.0\times$

10^{-1}　　　　　　　　　　　Cs>Sr>Ru　　（　　3　　）. ^{85}Sr　　^{134}Cs

　　　　　3　　（7　28　）　　　　　　　　　　　　　　　　　　　　　　　^{103}Ru

　　2　　（7　10　）　　　　　　　.　　　　　　　　　　^{134}Cs　　　67

　　^{103}Ru　4　　　　　　　　　.　　　　　　　　^{134}Cs

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　.

　　　^{85}Sr

^{103}Ru　　　　　　　　　　　　.

　　　　　　　　　　　　　4　　　.

　　　　　　　.　^{85}Sr　　^{103}Ru

　　　.

　　　　　　　^{134}Cs　　　　　　　　　　　　2　　3

　　　　　　　.　　　^{134}Cs　　　　　　　　　　　　　^{85}Sr　　^{103}Ru

. ^{134}Cs   4

^{103}Ru   600   .   1   3

Cs>Sr>Ru ^{85}Sr

. ^{85}Sr

.

10~ 1000   .

(   )   1 ^{85}Sr

^{103}Ru ^{134}Cs   3   (

66)   . ^{134}Cs   3

. ^{134}Cs

. ^{134}Cs   0.14~14.5%

.

.

5   (34)   (

)   2, 3

,   4   .

66~94%

.

57~69%

.

Table 1. Percent of initial deposition that remained in the soybean plant at harvest.

Date of RI application	Days to Harvest	Percent of initial deposition (%) [*]		
		Sr-85	Ru-103	Cs-134
June 19	105	0.30	0.14	9.92
July 10	84	0.61	0.89	37.19
July 28	66	0.89	0.89	41.93
Aug. 14	49	0.53	1.11	29.83
Aug.29	34	1.20	2.78	19.75
Sep. 15	17	6.96	14.53	14.83

[*]   Data for total defoliation

Table 2. Effect of the rain simulation on the activity remaining in the mature soybean plant.

Date of RI application	Rain simulation	Percent of initial deposition (%)		
		Sr-85	Ru-103	Cs-134
Aug. 29	Yes	1.20	2.78	19.75
Aug. 29	No	20.32	20.25	57.80

Table 3. Effect of the rain simulation on the seed translocation in the mature soybean plant.

Date of RI application	Rain simulation	Translocation factors		
		Sr-85	Ru-103	Cs-134
Aug. 29	Yes	5.35×10^{-5}	6.01×10^{-5}	1.15×10^{-1}
Aug. 29	No	1.38×10^{-4}	1.91×10^{-4}	2.65×10^{-1}

Table 4 Effect of the rain simulation on the activity distribution in the mature soybean plant.

Date of RI application	Rain simulation	Percent distribution in seeds (%)		
		Sr-85	Ru-103	Cs-134
Aug. 29	Yes	3.52×10^{-1}	1.88×10^{-1}	5.70×10^{1}
Aug. 29	No	6.08×10^{-2}	8.47×10^{-2}	4.48×10^{1}

21~83%

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.

$1m^2$ 1Bq

5   .

Cs   Sr   , Ru

Ru   Sr   .   Cs   Ru

60   13000   . ^{134}Cs ^{85}Sr

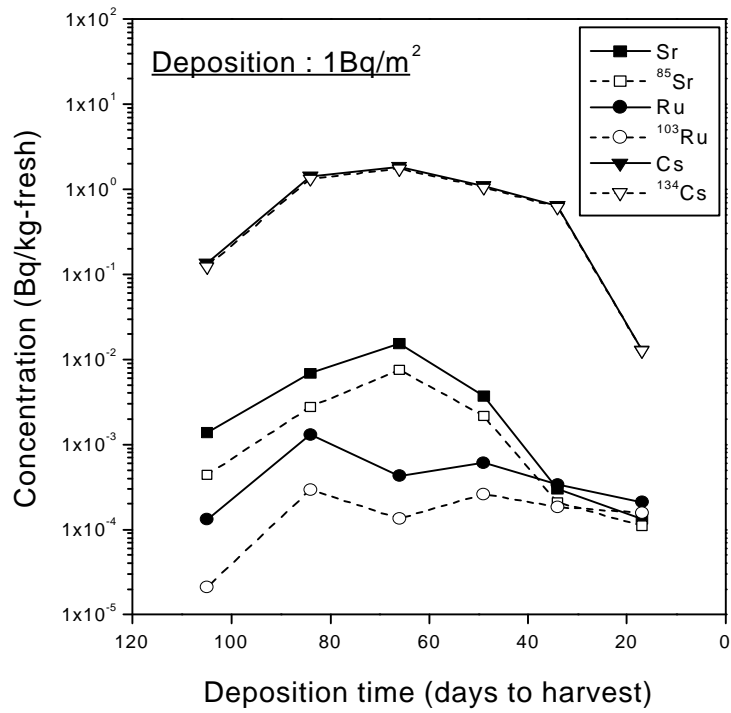^{103}Ru   .

Fig. 5. Radionuclide concentrations in the mature soybean
seed calculated assuming that the level of deposition
is 1Bq/m².

4.

. ^{85}Sr, ^{103}Ru, ^{134}Cs

0.93   .

. ^{85}Sr   56   , ^{103}Ru   4   , ^{134}Cs   67

^{134}Cs   .

. ^{85}Sr ^{103}Ru

^{134}Cs   2   3

.

. ^{85}Sr ^{103}Ru

^{134}Cs   3 ^{134}Cs   .

.

^{85}Sr ^{103}Ru   .

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