THE EFFECT OF THE SOIL pH ON ^{134}Cs TRANSFER FACTORS FOR SOYBEAN AND SUNFLOWER PLANTS; ^{134}Cs FATE IN THE EXTRACTED SEED-OIL

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The effect of soil pH on ^{134}Cs TFs as well as the fate of ^{134}Cs in the extracted oil was studied in a greenhouse experiment with soybean and sunflower plants. A soil with pH 4.2 was used as a basis and its pH value has increased to 5.7, 6.5 and 7.6 (by the addition of different amounts of $Ca(OH)_2$). The lowest TF value was observed in the calcareous soil (pH 7.6), while the highest in the lowest pH (4.2) for the vegetative part and in the pH 6.5 for the edible part for both studied plants. TFs were practically the same for soya plants grown on the three lowest soil pH and reduced significantly only at pH 7.6 for either pods or other plant material. However, the lowest/highest TF was ≈ 4 for pods and ≈ 6 for the other plant material. For the sunflower plants while TFs for other plant material reduced from lowest to highest soil pH by only a factor of 2, for the seeds TFs remained rather constant. The difference in TF between the two studied species in each soil pH was in some cases higher than the difference due to pH effect. When an oil fraction ($\approx$20%) was extracted from seeds of both plants, no ^{134}Cs was detected.

Introduction

Soya and sunflower plants were selected to investigate the fate of ^{134}Cs in the extracted oil in addition to the soil liming effect on TFs. Previous experiment with olive oil showed that although a significant amount of ^{134}Cs was measured in olives (grown on the light – acid soil) this was not transferred to the olive oil when an oil fraction (5% of f.w.) was extracted (Skarlou et al., 1999). Since olive oil and other seed - oils are important foodstuffs such information might have a wide application (if this can be verified for the commercially produced oils).

The experimental procedure was the same as the one of the paper entitled "The effect of soil pH and the fungicide "Captan" on ^{134}Cs transfer factors for cucumber and radish plants". The same soil of low pH was used and its pH value was increased by the addition appropriate amounts of $Ca(OH)_2$. Seed oil from both plants was extracted with ethyl-ether using a soxhelt apparatus.

Results and discussion

Transfer factors

The soil to plant transfer factor (TF) is defined as follows:

$$TF = \frac{\text{Activity concentration in plant (Bq kg-1 dry weight}}{\text{Activity concentration in soil (Bq kg-1 dry weight)}}$$

^{134}Cs transfer factors for the studied plants are presented in Table 1.

	Soya		Sunflower	
Soil pH Value	**Pods**	**Other Plant Material**	**Seeds**	**Other Plant Material**
pH 1 4.2	**0.206** ± 0.051	**0.134** ± 0.045	**0.106** ± 0.070	**0.682** ± 0.219
pH 2 5.7	**0.189** ± 0.041	**0.125** ± 0.037	**0.122** ± 0.041	**0.421** ± 0.017
pH 3 6.5	**0.221** ± 0.050	**0.128** ± 0.039	**0.157** ± 0.030	**0.418** ± 0.068
pH 4 7.6	**0.053** ± 0.011	**0.022** ± 0.004	**0.094** ± 0.026	**0.315** ± 0.094

TABLE 1: Transfer factors for of ^{134}Cs for Soya and Sunflower plants grown on a soil with different pH values

The lowest TF value for both crops was found in the calcareous soil as was the case for cucumber and radish plants.

TFs were practically the same for soya plants grown on the three lowest soil pH and reduced significantly only at pH 7.6. This trend was the same either for the pods or the

other plant material. However, the highest / lowest TF for soya plants was ≈ 4.0 for the pods and ≈ 6.1 for the other plant material.

For the sunflower plants the effect of liming was less pronounced. While TFs for other plant material reduced from lowest to highest soil pH (highest / lowest TF ≈ 2.2), for the seeds remained rather constant.

It is noticeable, that sunflower TFs for the vegetative part were much higher – up to 14 times - than soya (pH 7.6).

To exclude dilution effects due to different biomass production of the plants at different soil pH values, the total ^{134}Cs uptake (Bq/pot) was calculated using yield production. Bq/pot data are presented in Table 2.

	Soya		**Sunflower**	
Soil pH Value	**Pods**	**Other Plant Material**	**Seeds**	**Other Plant Material**
pH 1 4.2	**178.43** ± 31.42	**132.00** ± 24.43	**63.12** ± 85.97	**185.34** ± 155.87
pH 2 5.7	**162.13** ± 42.65	**137.53** ± 38.47	**58.87** ± 36.22	**151.96** ± 88.38
pH 3 6.5	**199.16** ± 53.59	**115.33** ± 41.47	**162.87** ± 53.73	**324.10** ± 105.37
pH 4 7.6	**42.89** ± 9.75	**26.70** ± 5.95	**77.28** ± 39.23	**189.45** ± 86.14

TABLE 2: ^{134}Cs Bq/pot for Soya and Sunflower plants grown on a soil with different pH values

Bq/pot values for soya plants present the same trends as TFs for both pods and other plant material, while for sunflower the highest Bq/pot values were observed at soil pH 3 and remained rather constant at the other soil pH either for the edible or the other plant material.

The interpretation of data either as TFs or as Bq/pot for soya, indicate that liming of the soil can reduce the ^{134}Cs uptake only if soil pH is above 6.5.

For sunflower no specific conclusion can be drawn for the effect of soil liming and the subsequent increase of soil pH on ^{134}Cs uptake.

Although a significant amount of ^{134}Cs was measured in soya pods and sunflower seeds this was not transferred to the seed oil when an oil fraction (≈20% of f.w.) was extracted.

Thus, ^{134}Cs is not transferred to soya oil or sunflower oil as was the case for the olive oil although the method of oil extraction was not the same.

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