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6.4	Characterisation of the statistical distributions of chemical contaminants at CCPs and analysis of WP1-WP5 for multiple/combined combinations	6	HFSO	R	PU	M24

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SEVENTH FRAMEWORK PROGRAMME

EXPLANATION

The main objectives of the WP6 are

☐ Review of existing and define of new mathematical models in predictive microbiology

☐ To investigate correlations between food risk factors and traceable environmental parameters and contamination indicators

☐ To consolidate existing and new models for microbial growth as a function of intrinsic environmental factors and extrinsic parameters

The delivery D6.4 'Characterisation of the statistical distributions of chemical contaminants at CCPs and analysis of WP1-WP5 for multiple/combined combinations' contributes to the second objective through characterising the distribution of chemical contaminants and pesticide residues in primary and composite samples as a prerequisite for the determination of sampling uncertainty and an efficient elaboration of risk-based sampling strategies.

Specifically, D6.4 addresses the Sub-task 6.2.2 Elaboration of Sampling strategies for Chemical Contaminants, and for Task 7.2. Estimation of uncertainty of sampling carried out according to the sampling methods specified in EU protocols by investigating the statistical distributions of chemical contaminants.

For chemical contaminants and pesticide and veterinary residues the critical control point (CCP) is the time when the food is marketed or offered for sale at the first time.

Delivery D6.4 provides the results of the statistical analysis of the distribution of residues and chemical contaminants in food representing two distinctly different situations. The analyte concentration distributions exhibit a continuous, typically unimodal but strongly skewed pattern. Whereas the distribution of pesticide residues in fruits and vegetables is very heterogeneous, the PCBs and Aflatoxin M contamination in bulk milk batches can be considered well-mixed and compared with the analytical uncertainty it has negligible sampling uncertainty

The statistical analyses presented in D6.4 have been performed based on the data collected or generated by WP3 and WP5 for the identified food-risk combinations, and by WP7 on residues in crop units (primary samples). In addition, data on pesticide residues in or on crop units, were collected from scientific literature and included in the evaluations of D6.4.

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SEVENTH FRAMEWORK PROGRAMME

Summary

In order to provide a comprehensive and complete coverage, this report contains all results obtained within the activities related to WP6 and relevant for D6.4 during the implementation of the project.

Pesticide residue data obtained within the programme of WP5 and WP 7, as well as from the scientific literature were used for the characterization of the nature of the distribution of pesticide residues in crop units and composite samples. The 19637 residue data representing the normal agriculture practice in 15 countries from 4 continents are suitable for drawing generally applicable conclusions.

The nature of the distribution of pesticide residues in crop units were examined using graphical statistical representations of the residue levels at randomly selected positions on the treated fields, and the probability density functions of the residues were calculated. Further on, various parametric distributions were fitted to the experimental data to determine if any of them can be used to reliably describe the nature of the residue distributions. The goodness of the fit was characterised with the sum of squares of the relative differences of the selected percentiles (e.g. 95 or 98) of the input experimental data and the fitted distributions. Generally the lognormal distribution gave the best fit for the relative frequency distributions of residues.

The range of residues observed in field experiments and market samples was characterised by the relative standard deviation (CV) enabling the comparison of data sets with different mean values. The effect of sample size on the parameters of the distribution of residues was studied with drawing random samples with replacement from the experimental data sets.

In view of the wide variation of CV values observed in simulated data sets, the differences in CV values of residues measured in primary samples cannot be considered significant. Therefore, the variation of residues which might have resulted from the nature of the crops, physical-chemical properties of the pesticides, methods of application, and the actual field and weather conditions cannot be distinguished with samples of size 100-120 available from a single field or lot.

The average of CV values obtained in individual residue data sets consisting of over 100 data gave the best estimate for the variability of residues in the parent population. The CV values of residues in composite samples were inversely proportional to the square of sample size enabling the estimation of variability of residues in composite samples of various sizes from the CV value of residues in primary samples.

The estimated typical variability of residues in *fruits and vegetables* expressed as CV in primary (n=1) and composite samples of size 5, 10 and 25 were:

Sample size	1	5	10	25
CV (Market samples)	1.1	0.47	0.34	0.21
CV (Field samples[1])	0.8	0.356	0.25	0.16
CV (Brassica leafy and leafy vegetables)	0.7	0.31	0.22	0.14

1. Except Brassica leafy and leafy vegetables

The larger variability of residues in market samples compared to field samples is attributed to the potential mixing of lots and the larger proportion of residues below the LOQ in market samples.

The leafy vegetables are grown flat on the soil surface and the pesticide deposit is probably more uniform than in case of fruit trees, bushes or greenhouse crops grown on cordons.

The above estimates are not applicable for cereal grains and small seeds because no residue data were available for these crops.

The average variability of residues in replicate composite field samples were somewhat higher than those estimated from residues in crop units, but they were within the 95% confidence interval (0.10-0.46) for the estimated typical CV values (Ambrus & Soboleva, 2004).