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Probabilistic intake calculation from pesticide residues in apples sprayed by two different application techniques.

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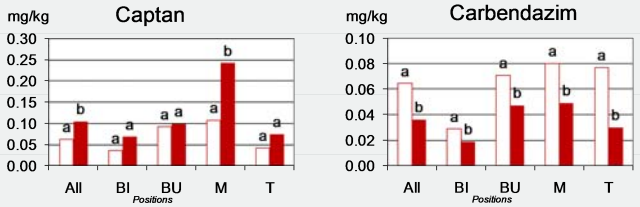

Figure 1a+b. Mean values of captan and carbendazim analysis of individual apples picked at four positions. BI: bottom inside, BU: bottom outside, M: middle, T: top. Additional the mean value for all apples are shown. White bars are Standard application (fine droplets); red bars are Venturi application (coarse droplets).

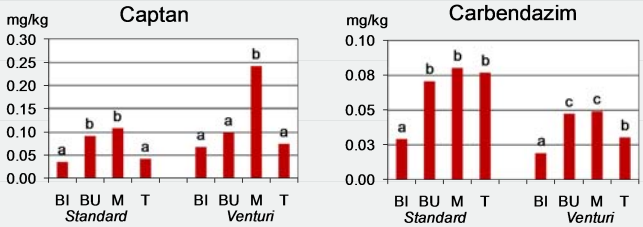

Figure 2a+b. Mean values of captan and carbendazim from analysis of individual apples picked at 4 positions. BI: bottom inside, BU: bottom outside, M: middle, T: top. Group factor a, b or c are annotated above the bars.

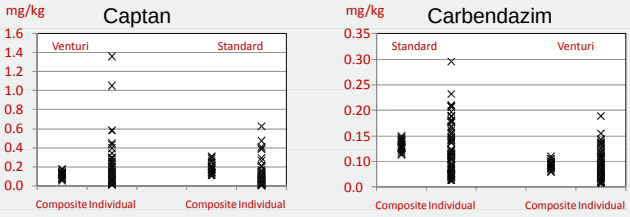

Figure 3a+b. Results for composite and individual samples for captan and carbendazim. Results are shown for both Standard application (fine droplets) and Venturi application (coarse droplets).

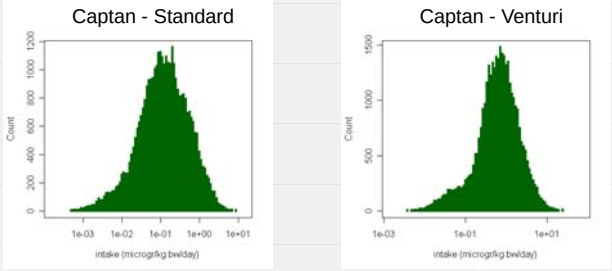

Figure 4a+b. Distribution of the intake from the probabilistic exposure calculation performed on individual results of captan for both Standard and Venturi application techniques.

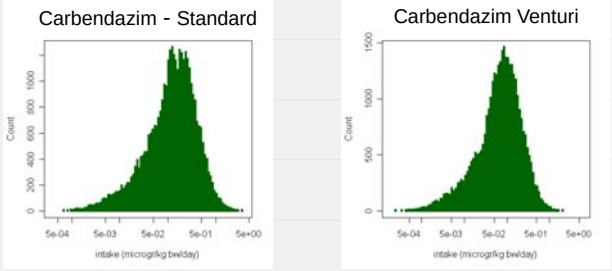

Figure 5a+b. Distribution of the intake from the probabilistic exposure calculation performed on individual results of carbendazim for both Standard and Venturi application techniques.

Introduction

An investigation within the ISAFRUIT project with the purpose to find solutions to decrease the pesticide amount used for apple production and the pesticide residues in the fruits. The aim was to find the residue variability associated with individual apples samples, for two application techniques; i.e. fine and coarse droplet spray application. The residue data produced in this study is further used for probabilistic acute intake calculations.

Methods

A spraying trial was conducted in 2007 in a commercial orchard in the Netherlands with the apple variety Elstar. The apples were sprayed with thiophanate-methyl, boscalid, bupirimate, captan, pirimicarb, pyraclostrobin. The application modes were a) Venturi nozzle, coarse droplet and b) Standard nozzle, fine droplet . The apples were pícked at four positions within the apple tree: 1) Top, 2) Middle, 3) Bottom outside, 4) Bottom inside. All 160 apples were analysed individually. The software MCRA version 6.2 and Danish consumption data were used for the probabilistic calculations.

Results and conclusion

The mean values for the two applications have been statistically evaluated. Only the data for captan and carbendazim (degradation product of thiophanate-methyl) are included in this presentation.

Figure 1a+b shows the mean residue values from the 4 positions of both application modes and the corresponding group factor, a or b. The statistical evaluation showed that Venturi application resulted in higher mean residue levels for captan for the 'middle' position. For carbendazim the Venturi application gave higher residue levels at all positions, probably due to higher degradation rates of thiophanate-methyl, when fine coarse droplets are used.

Figure 2a+b show the statistical evaluation of residue levels at different position. Mainly 'Bottom inside' and 'top' positions had lower residue levels than the other positions.

The variability factors have been calculated for both applications (n=80) and were 9.4 and 4.3 for captan and 1.8 and 0.9 for carbendazim. To examine the relation between individual results and average results, composite samples were statistically constructed from ten of the individual results. The individual and composite concentrations are seen in **Figure 3a+b**. The composite samples showed significant less variability.

Probabilistic calculations of the exposure were performed on both application techniques. **Figure 4 and 5** show the distributions. The distributions calculated for the Standard applications showed a broader peak shape, especially for Captan. Due to two samples with very high captan residue level, the Venturi application resulted in higher intake. For Carbendazim the standard application gave higher intake.

The 99.9 percentile for captan was 3.7 and 6.8 µg/kg bw/day, well below the ARfD of 100 µg/kg bw/day for captan. For carbendazim the 99.9 percentile was 1.7 and 0.95 µg/kg bw/day, also below the ARfD of 20 µg/kg bw/day.