

Assessment of exposure of workers to pesticide residues in tomato greenhouses

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Introduction

During cultivation, tomato require the use of a broad range of pesticides to prevent and control pests and diseases. Tomato are sprayed several times and up to the final harvest. Pesticides are considered necessary by farmers to provide high crop yields ensuring food security, high agriculture productivity and good quality products. Many pesticides applied on tomato are persistent, dislodgeable by contact with the hands, and fat-soluble. As they can easily be absorbed through skin contact, farm workers who harvest tomato daily and for several hours can potentially be exposed to residual deposits of pesticides and possibly endanger their health.



Objective

The aim of this study is to assess the potential dermal exposure of farm workers to dislodgeable pesticide residues during re-entry activities (harvesting).



Materials & methods

Ten volunteers working in tomato greenhouses located in Sousse governorate (Tunisia) were chosen at random to evaluate their potential dermal exposure (PDE).



Two pairs of cotton gloves were distributed to each worker and worn during two consecutive half days during harvesting fruits in 10 tomato greenhouses (from min 2 h to max 3 h/day).

Gloves analysis : multi-residue **QuEChERS** method and a combination of gas and liquid chromatography tandem mass spectrometry (**GC-MS/MS and LC-MS/MS**)

$$\text{PDE (mg / kg bw per day)} = (\text{C T (mg / kg)} \times \text{GW (kg)} \times 4) / \text{bw (kg)}$$

C : the concentration of the substance in the sub-sample (5 g),
GW : the average weight of the cotton gloves samples (61 g ± 3.27 g),
T : the task duration (2 h during the trial; 8 h per day),
bw : the body weight (conventionally, 60 kg).

Risk : PDE > AOEL

AOEL : Acceptable Operator Exposure Level



Results & Discussion



Global Results of Analyses of Residual Deposits

A total of **57** pesticide residues were detected on all the gloves worn by people working in tomato greenhouses (average: **18** pesticide residues per sample) with an average total concentration of **111 ± 193** mg/kg.

The most severely contaminated sample accumulated a total concentration of residues up to **622** mg/kg

Propamocarb was detected in all samples (**100%**), followed by diafenthiuron (**90%**) and thiophanate methyl (**80%**).



Potential dermal exposure (PDE)

AOEL exceedances :

azoxystrobine (**124%**), tebufenpyrad (**128%**), spinosad (**224%**), cyhalothrin Lamda (**253%**), bifenazate(**508%**), cyhalothrin Gamma (**530%**), chlorothalonil (**723%**), carbendazim and benomyl (**813%**), chlorpyrifos ethyl (**1382%**), flubendiamid (**1734%**), thiophanate methyl (**2831%**) and indoxacarb (**3397%**)



Conclusion

According to potential dermal exposure values, workers who spend several hours on a daily basis in greenhouses are at risk during re-entry activities, with potential effects on their health. There is an urgent need for awareness raising amongst professionals' and training on good practices and hygiene rules to avoid their excessive exposure. This survey should be completed later by a bio-monitoring of the operators during spraying and workers during re-entry activities, with analysis of blood, urine and hair samples.



References

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