

Phytotoxicity and uptake of chlorpyrifos in cabbage

Zhi-Yong Zhang · Wei-Li Shan · Wen-Cheng Song ·
Yong Gong · Xian-Jin Liu

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Abstract Chinese cabbage, *Brassica chinensis* L., and cabbage, *Brassica oleracea* L. var. *capitata*, are the main daily foliar vegetables of the vast majority of the population of eastern and southern China. Cabbages are also planted and consumed widely in other countries. The insecticide and acaricide chlorpyrifos is registered in many countries. Chlorpyrifos controls a variety of insects in plants and soils, and chlorpyrifos is extensively used in the Chinese market. Food poisoning due to the presence of organophosphorus pesticide residues in vegetables has been reported in China provinces. Plant uptake of pesticide residues in air, water, and soil is a source of pesticide residues in vegetables. Here, phytotoxicity and uptake of chlorpyrifos by Chinese cabbage and cabbage were studied in the laboratory using the batch technique. From 0 to 16 days after chlorpyrifos treatment, vegetables roots, stems, leaves, and culture water samples were collected, and the residues of chlorpyrifos in culture water, plant tissues were analyzed using GC-FPD. The results demonstrate that culture solutions with chlorpyrifos had no sig-

nificant inhibitory effects on vegetable plant height. However, at 1.0 mg/l, it had significant inhibitory effects on the root length and fresh weight of Chinese cabbage. Then, at 10.0 mg/l, it had only significant inhibitory effects on the root length and fresh weight of cabbage compared to the control treatment. The disappearance rates of chlorpyrifos in solutions were in sequence as: nutrition solution with Chinese cabbage, nutrition solution with cabbage, pond water, nutrition solution. The results showed also that chlorpyrifos can be taken up by roots of Chinese cabbage and cabbage from water and subsequently translocated as a function of time. Uptake dynamics of chlorpyrifos from culture solutions by the two cabbage plants were similar.

Keywords Chlorpyrifos uptake and translocation · Phytotoxicity · Vegetable

Introduction

Vegetables play important roles in human nutrition and health by providing minerals, micronutrients, vitamins, antioxidants, phytosterols, and dietary fiber (Wennberg et al. 2006). In China, for example, vegetables comprise about 10% of the daily food of the Chinese population (Zhu and Zhou 2001), but the average yield per hectare is relatively low. Vegetables are susceptible to attacks from insect and disease, so pesticides are widely used. Usually, less than 0.1% of pesticides on crops actually reach the target pests, and over 99% of pesticides move into ecosystems, thus polluting the land, water, and air (Pimentel and Levitan 1986).

Chlorpyrifos is an organophosphate, which is manufactured and marketed as an insecticide and acaricide. It is registered in many countries and sold under various names.

Z.-Y. Zhang · X.-J. Liu (✉)

Key Laboratory of Food Safety and Quality of Jiangsu Province/
Key Laboratory of Food Safety Monitoring and Management
of Ministry of Agriculture/Institute of Food Safety and Quality,
Jiangsu Academy of Agricultural Sciences, Nanjing, Jiangsu
210014, China
e-mail: yzuzzy@163.com

W.-L. Shan · W.-C. Song · Y. Gong
Institute for the Control of Agrochemicals, Ministry
of Agriculture, Beijing 100125, China