ABSTRACT

Endosulfan 3 EC was sprayed on field-grown pepper, melon, and sweet potato plants at the recommended rate. Plant tissue samples (leaves, fruits, and edible roots) were collected at 1 to 30 days following spraying and analyzed for endosulfan isomers (n- and p-isomers). GC-MSD results indicated the formation of the endosulfane oxides of m/z 170, 272, and 387 that correspond to endosulfane sulfoxide as the major metabolite of endosulfan and the relatively higher abundance of the p-isomer as compared to the n-isomer. The initial fast reaction (n- and p-isomers plus endosulfane sulfoxide) was higher on leaves than on fruits. On pepper and melon fruits, the p-isomer which is the minor isomer in metabolism, decreased faster than n-isomer. However, on sweet potatoes, the p-isomer persisted longer than n-isomer. These results confirm the greater volatility of the endosulfane oxides toward the p-isomer, which can ultimately impact endosulfan elimination in the environment. Antioxidant metabolite, on the other hand, the higher initial residues of endosulfan on pepper and sweet potato leaves should be considered of great importance for timing the safe entry of handlers due to the high-marijuana facility of endosulfane sulfoxide.

INTRODUCTION

The demonstration of the effectiveness of a pesticide is not itself sufficient to recommend its use in the greenhouse. A detailed understanding of the fate and transport of the material within the greenhouse environment is essential to its eventual consumption. This involves knowledge of the processes involved in the degradation, transformation, and movement of pesticides, which occur both within the plant and in the soil. In addition, the effects of these processes on the environment should be evaluated. The objectives of this study were to: (1) evaluate the metabolism of endosulfan in three field-grown vegetables; (2) determine the relationship between endosulfan and its metabolites in the plant material; and (3) identify the potential impact of endosulfan on the environment.

MATERIALS AND METHODS

Plants were sprayed with endosulfan 3EC formulation at a rate of 60 kg/sa in a total volume of 150 l/m² of water using in a portable pump spray packed with one caprinic nozzle operated at 45 psi (275 kPa).

RESULTS AND DISCUSSION

Half-life values of endosulfan (Table 1) indicated the persistence of the p-isomer than the n-isomer. Studies carried out by other investigators on cotton plant (Gossypium hirsutum L.) grown under greenhouse conditions revealed that the half-life (H_0) of the p-isomer was greater than that of the n-isomer. Studies on the metabolism of endosulfan in crops and other plants have also shown that the half-life of the p-isomer was greater than the n-isomer. The half-life of the n-isomer was converted to the p-isomer in most quantities, while it was converted into endosulfane sulfoxide on stalks and leaves in significant amounts. Pepper and melons are perishable crops which must be harvested frequently and regularly and are usually marketed and consumed as fresh foods. Metabolites having long post-harvest ripening periods are not compatible with vegetable production. Endosulfan residues detected on pepper and melon fruits were the result of only a single application of endosulfan 3EC. The higher initial total residues of endosulfan in pepper and melon fruits were noted at 1 day following spraying, as expected, and decreased slowly, reflecting the low volatility of endosulfane oxides. However, endosulfan residues in treated pepper and melons fruits may exceed the tolerance level of 0.05 mg/kg for indoor agricultural use where endosulfane sulfoxide is recommended on a two-week schedule for control of many vegetable insects.

ACKNOWLEDGMENTS

We thank Eric Turley, Regina Hill, Daniel Stone, and Janet Pfister for their assistance in the field study. This investigation was supported by a grant from USDA/CREES to the University of Kentucky under agreement No. J-OCE 05-43F.

REFERENCES


Table 1: Initial residues remaining one hour following endosulfan 3EC spraying. Residues decreased significantly (p < 0.05) values of endosulfan isomers (n- and p-isomers) and total endosulfane (EC EC > 0.05) on leaves of three plant species: Pepper, melon, and sweet potato grown at the University of Kentucky Agricultural Research Farm, Franklin County, Kentucky, U.S.

<table>
<thead>
<tr>
<th>Plant Species</th>
<th>n-Isomer</th>
<th>p-Isomer</th>
<th>Total Endosulfane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pepper</td>
<td>1.60</td>
<td>2.10</td>
<td>3.70</td>
</tr>
<tr>
<td>Melon</td>
<td>1.22</td>
<td>3.04</td>
<td>4.26</td>
</tr>
<tr>
<td>Sweet Potato</td>
<td>0.39</td>
<td>0.90</td>
<td>1.29</td>
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</tbody>
</table>

NOTE: No differences = Not applicable.