Dissipation and accumulation of quinalphos in chillies
(Capsium annum L.)

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Quinalphos (0, 0, diethyl O-quinoxalin-2yl phosphorothiate) as contact insecticide, is one of the widely used organophosphorus compounds against a number of crop pests (Tomlin, 1994). It is used on vegetable crops especially in chillies against thrips, Scirtothrips dorsalis and Spodoptera litura Fabricious (Kumaresan et al. 1988). It has been found to be quite effective for the control of fruit borer (Veeravel and Baskaran, 1977). Extensive and repeated use of this chemical may leave toxic residues on the produce meant for human consumption, which may prove harmful to consumers if present in quantities above the tolerance limit. Information on the dissipation of these insecticides on vegetable crops like chillies is meagre. Therefore, in order to assess the residue levels and to fix the safe waiting period, a study was undertaken to see the dissipation pattern of quinalphos on chillies as a part of the All India Co-ordinated Research Project (AICRP) on Pesticide Residues programme.

Field studies were conducted during Rabi 1995 to estimate the residues of quinalphos with variety Gundu type. The experiment was taken up during 1995-96 in a farmer’s field at Kondayampalayam village near Thondamuthur in Coimbatore district with plot size of 3 x 4 cm and replicated four times in a randomised block design. Quinalphos 25 EC (Ekalux 25 EC) was used for spraying, with the help of knapsack sprayer at the rate of 500 L spray fluid per hectare. The treatments include quinalphos at the rate of 1000 ml ha\(^{-1}\) (T1 – recommended dose), 2000 ml ha\(^{-1}\) (T2- Double the recommended dose) and control (T3). Each chemical treatment was given during flowering stage 45th days after transplanting and one month after first spray. The samples of green chillies were drawn randomly, collected from each plot at an interval of 0, 1, 3, 5, 7 and 15 days after the second spray.

The representative chopped green chillie samples (50 g) were homogenized with acetone thrice (100, 40, 40 ml) in a waring blender for one minute. The extracts were filtered through buchner funnel under mild suction. The filtrate was evaporated to dryness in a rotary vacuum evaporator to free of acetone. The acetone free extract was transferred to a seperatory funnel, partitioned using 100 ml of dichloromethane, 20 ml of saturated sodium chloride and 100 ml of distilled water were added. The dichloromethane layer was separated, concentrated and cleaned by column chromatography using an adsorbent mixture (activated charcoal and silica gel 1:10) in between two layers of anhydrous sodium sulphate (2.5 cm). The elution was done with 100 ml redistilled dichloromethane. The dichloromethane extract collected and concentrated to dryness was redisolved in acetone (10 ml) for Gas chromatograph analysis by Chemito model 3800 equipped with Nitrogen Phosphorus detector. Aliquots (2 μl) of extracts were injected into 4% S.E. 30 glass column at a column temperature of 200°C. The injection and detector temperatures were 220 and 240°C respectively. The carrier gas flow N\(_2\) 30 ml min\(^{-1}\); 10 ml min\(^{-1}\) and zero air 100 ml min\(^{-1}\). The retention time (RT) at these parameters was 2.72 min. The method offered a sensitivity of 0.5 ng and a limit of detection of 0.01 mg kg\(^{-1}\) (on 50g sample basis). The rate of dissipation of quinalphos residues were worked out by determining RL\(_{50}\) values (Half life period) using Hoskins formula (Hoskins, 1961). Waiting periods \(t_{\text{max}}\), i.e. tolerance limit are calculated on the basis of theoretical maximum residue limit (FOA, 1991).

The residue data of quinalphos on the marketable green chillies collected after two sprays are presented in Table 1. Application of quinalphos @ 0.05 per cent resulted in the average residue
Table 1. Residues of quinalphos in fresh chillies fruits (mean of four replications) in ppm

<table>
<thead>
<tr>
<th>Samples collected in days after treatment</th>
<th>T₁-Quinalphos @ 0.05% concentration level</th>
<th>Dissipation %</th>
<th>T₁-Quinalphos @ 0.10% concentration level</th>
<th>Dissipation %</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4.112</td>
<td>-</td>
<td>7.78</td>
<td>-</td>
</tr>
<tr>
<td>1</td>
<td>2.067</td>
<td>47.7</td>
<td>3.97</td>
<td>49.0</td>
</tr>
<tr>
<td>3</td>
<td>0.906</td>
<td>71.9</td>
<td>1.362</td>
<td>82.2</td>
</tr>
<tr>
<td>7</td>
<td>0.363</td>
<td>91.2</td>
<td>0.572</td>
<td>92.6</td>
</tr>
<tr>
<td>10</td>
<td>0.127</td>
<td>96.9</td>
<td>0.212</td>
<td>97.3</td>
</tr>
<tr>
<td>15</td>
<td>0.015</td>
<td>99.6</td>
<td>0.060</td>
<td>99.2</td>
</tr>
</tbody>
</table>

T₁(0.5) days* 1.88  2.25  
T₁(MRL) days** 7.40  9.88

* Half life period
** Waiting period

on 4.112 ppm in chillies fruits on ‘0’ day (after one hour) and reduced to 2.067, 0.906, 0.363, 0.127 and 0.015 ppm respectively on 1, 3, 7, 10 and 15 days after application. Thus recording about 49.7, 77.9, 91.2 and 99.6 per cent dissipation losses of initial deposit respectively. The quinalphos spray of 0.1 per cent concentration after second application resulted in initial deposit of 7.78 ppm after an hour (0 day) and reduced to 3.97, 1.362, 0.572, 0.212 and 0.060 ppm respectively. The quinalphos residues persisted in chillies fruit even after 15 days of application. Average residues of quinalphos in 10 days and thereafter found to be below the maximum permissible residue limit (MRL) of 0.25 ppm (FAO, 1991). This is in accordance with the findings in residues in brinjal (Rajkannu et al. 1980). The calculated time required for quinalphos residues to reach half of its initial deposit varied with 1.88 days for normal dose and 2.25 days for the higher dose. The preharvest waiting period of 7.36 and 9.83 days are necessary for the safe harvest of chillies at 0.05 and 0.10 per cent quinalphos spray respectively. The findings are in agreement with the earlier observations on rapid dissipation of the insecticide on brinjal (Rajkannu et al. 1980). Rapid dissipation of quinalphos residues in/on chillies fruit observed in the present study may be attributed to fast degradation of the compounds as well as dilution due to rapid growth of the fruits in addition to verticality of fruits.

It can be concluded from the present study that quinalphos is suitable for application of chillies as its residue arising from the recommended dose of application, fall below MRL value of 0.25 mg kg⁻¹ in 10 days last spray. Therefore, a waiting period of 8 days is recommended.
Phosphorus fixing capacity in major red soil series of Dharmapuri district, Tamil nadu

References


Rajkannu, K., Saivaraj, K., Vasu Devan, P. and Balasubramanian, M (1980). Residues of certain newer insecticides in brinjal. Pesticides 14: 14-17


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Research Notes

Phosphorus fixing capacity in major red soil series of Dharmapuri district, Tamil nadu

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Fixation of phosphorus generally implies the conversion of the applied phosphorus, which is water or citrate soluble to a more insoluble form. This insoluble phosphate is either consumed by soil microorganisms or precipitated by soluble cations in the soil solution, or adsorbed by the colloidal complex of the soil. For the present purposes it may be warranted to investigate this important problem since it is so closely connected with the economics of phosphorus nutrition to crop and also may remove misconceptions about it that prevails among farmers, fertilizer manufacturers and other personnel interested on phosphorus nutrition. Therefore the present investigation was carried out during 1994-95 to determine the quantitative fixation of added phosphorus in major red soil series of Dharmapuri District, Tamil Nadu.

Four major red soil series viz. Vannapatti, Hosur, Krishnagiri and Sonnepuaram were chosen for this study. Soils from two locations representing the above series were collected and processed for chemical analysis. The pH was determined in a 1:2.5 soil water suspension, Party size distribution was determined as outlined by Piper (1950). The organic carbon was determined following the Walkley and Black method as outlined by Piper (1950). Available P was estimated by the method of Olsen's outlined by Jackson (1973) and the results are furnished in Table 1.

To study the quantitative fixation of added phosphorus, various concentrations of P in the form of KH₂PO₄ were prepared and added to the soil so as to supply various concentrations of P as in Table 2. The contents were mixed and allowed for 96 hours at room temperature for equilibration. The P was estimated using Olsen's extractant (Jackson, 1973) and the P fixed was calculated.

The soil series varied considerably in the matter of P fixation (Table 2). The P fixation was progressively increased by the progressive increase in added P. However, the percentage of fixation was declined by the addition of P. Among the different soil series investigated,