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Review article

A BRIEF REVIEW ON DISSIPATION PATTERN OF INSECTICIDES ON PIGEONPEA

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INTRODUCTION

Pigeonpea (*Cajanus cajan* L. Millsp.) is an important pulse crop in the semi-arid tropics and subtropical farming systems, providing high quality vegetable protein, animal feed and firewood (Mittal and Ujagir, 2005). Indiscriminate use of pesticides led to the hazardous impacts of polluting food stuffs, water, air, soil and even human body. As a result, the beneficial effects of pesticides often get diluted due to the possible health hazards caused by their toxic residues left over *via* bio-magnification of their residues through the food chain and decomposition of same in the body fat. Since pigeonpea is a food crop, it may carry residues which warrant judicious use of pesticides in respect of persistence, dissipation, metabolism, movement and accumulation of residues. The analysis of pesticide residues on or in the pod is therefore essential to avoid the health hazards to the consumers by prescribing the waiting periods so that residues get dissipated down to the prescribed Maximum Residue Limits (MRL) before consumption to avoid toxic hazards. One of the important reasons for change from chemical pest control to IPM is to rationalize the use of need based insecticides so as to minimize the contamination of feed and various components of environment, as these in turn pose toxicity hazards to all forms of life including man. It is therefore, necessary to monitor the pesticide residues in food commodities and to evaluate the safety of commonly used pesticides in crops.

Therefore, keeping in view of the above discussions the available literature related to the dissipation of insecticides in pigeonpea has been reviewed.

Synthetic Pyrethroids

Patel *et al*. (1990) reported that the levels of fenvalerate in pigeonpea grains at harvest did not exceed the maximum residue limit of 1 mg kg^{-1}.

Dikshit and Singh (2000) determined the level of beta-cyfluthrin residues in chickpea when sprayed against gram pod borer *Helicoverpa armigera* at 18.75 and 37.50 g a.i. ha^{-1}. Beta-cyfluthrin residues in pod samples at 18.75 g a.i. ha^{-1} were 1.20 mg kg^{-1}, 0.64 mg kg^{-1} and 0.08 mg kg^{-1} at 0, 3 and 10 day respectively and at 37.50 g a.i. ha^{-1} recorded initial deposits of 2.00 mg kg^{-1}, 0.28 mg kg^{-1} at 0 and 7 day respectively. No residues from either application rate treatment by day 20 and day 7 in pod samples and shelled grains from pods respectively. Reddy *et al.* (2001) reported that the residues of deltamethrin (0.004%) were found below the maximum residue limit in grains and pod covers of pigeon pea at harvest when compared to fenvalerate in pigeonpea.

Debi Sharma and Awasthi (2002) reported from periodic dissipation studies of lambda -cyhalothrin in cauliflower cv. F1 hybrid NS-60N curd that the initial deposits of lambda -cyhalothrin 2.5 and 5 EC formulations at 15 and 30 g a.i.ha^{-1} were high from all the treatments(0.81 to 1.59 mg kg^{-1}). These dissipated quickly to reach below detectable limits by 10-15 days. The half lives (RL_{50}) of lambda -cyhalothrin in cauliflower were 2.0-2.2 days for the 2.5 EC formulation and 2.2-2.4 days for the 5.0 EC formulations, while the waiting periods (T_{tol}) were between 4.2-4.5 and 5.0-5.2 days for the 2.5 and 5.0 EC formulations, respectively.

Mathirajan (2002) determined that when lambda-cyhalothrin 5 EC in/on tomato fruits applied at the rates of 7.5, 15 and 30 g a.i. ha^{-1}, the lowest dose persisted to detectable level for 5 days while at the medium and highest dose, it persisted for 7 days and reached below detectable level after 10 days of application. Singh and Singh (2003) reported that the application of lambda-cyhalothrin at 25 and 50 g a.i. ha^{-1} to chickpea twice (pod initiation stage and at 15 days thereafter) resulted in initial residues of 0.335 and 0.462 mg kg^{-1} with half life values of 4.9 and 5.0 days respectively, on green pods. At harvest, the residues in grains were below the detectable level. Karabhantanal and Awaknavar (2007) reported that when tomato variety "PKM-1" was sprayed with beta-cyfluthrin 2.5 EC at 7.81 g a.i. ha^{-1} the average initial deposit of 0.925 mg kg^{-1} was found non detectable level after 7 to 10 days of application. The average waiting period was worked out to be 6.75 days and half-life ($t_{1/2}$) value calculated to be 2.10 days. Singh and Singh (2007) reported that when beta-cyfluthrin applied at 12.5 and 25 g a.i. ha^{-1} initial deposits in green pods were 0.109 and 0.135 mg kg^{-1}, which dissipated to the extent of 88.10-92.60 per cent with half life of 3.34 and 4.01 days, respectively. The safe waiting periods were 3 and 5 days respectively. At harvest, the residues were below detectable levels (< 0.008 mg kg^{-1}) in grains and pod covers in chickpea.

Singh *et al.* (2010) reported that the maximum residue level for beta-endosulfan, lambda-cyhalothrin and cypermethrin in brinjal crop were 0.08, 0.12 and 0.13, respectively. None of the samples exceeded their respective maximum residues limit. Kousik Mandal Chahil *et al.* (2010) observed that when combination formulation of Solomon 300 0D (beta-cyfluthrin 9% + imidacloprid 21%) sprayed @ 60 and 120 g a.i. ha^{-1} at 7 days interval half life periods observed for beta-cyfluthrin and imidacloprid were 1.74, 1.39 days and 2.31, 2.18 days respectively. Beta-cyfluthrin residues dissipated below the limit of quantification of 0.01 mg kg^{-1} after 5 and 7 days where as imidacloprid took 10 days for both the dosages to dessipate in brinjal.

Mahmoud and Soliman (2011) reported that the residues of lambada-cyhalothrin, in cowpea pods after 15 days were non detectable and half life value ($t_{½}$) was 0.95 days.

Flubendiamide

Hall (2007) reported that flubendiamide poses no risk to the soil environment and also further reported that flubendiamide has a highly favourable ecological profile and can be used effectively in an IPM program. Sahoo *et al.* (2009) found that average initial deposits of flubendiamide on chilli were found to be 1.06 and 2.00 mg kg^{-1}, respectively, following two applications of flubendiamide 480 SC at 60 and 120 g a.i. ha^{-1} at 10 days interval. More than 80 per cent of flubendiamide residues dissipated just after three days of the last application at both the dosages. Residues of flubendiamide dissipated below detectable level of 0.01 mg kg^{-1} in 7 and 10 days at single and double dosages, respectively. Half-life ($t_{1/2}$) of flubendiamide on chilli was observed to be 0.96 and 0.91 days, respectively, at single and double dosages.

Mohapatra *et al.* (2010) evaluated that the persistence of flubendiamide in cabbage and soil following two applications of flubendiamide 480 SC at 24 and 48 g a.i. ha^{-1}. Initial residue deposits of flubendiamide in cabbage were 0.33 and 0.49 mg kg^{-1} respectively. The residues persisted for 10 days from both the treatments with the half-life of 3.9 and 4.45 days, respectively. Des-iodo flubendiamide, a metabolite of flubendiamide, was not detected in cabbage at any time during the study period. Soil sample collected from the treated field after 15 days was free from any residue of flubendiamide or its metabolite. Rubaljot Kooner *et al.* (2010) found that half-lives values for flubendiamide following its three applications at 10 days intervals @ 48 g a.i. ha^{-1}were observed to be 0.33 and 1.00 day, respectively on tomato. Similarly, at the same application rate these values for thiacloprid were found to be 1.18 and 0.95 days, respectively. Flubendiamide and thiacloprid residues were observed to dissipate below their determination limit of 0.01 mg kg^{-1} after 3 and 5 days, respectively, when applied @ 48 g a.i. ha^{-1}. Soil samples collected after 15 days did not show the presence of flubendiamide, desiodo flubendiamide and thiacloprid at their determination limit of 0.01 mg kg^{-1}.

Chawla *et al.* (2011) reported that the residues estimated using HPLC revealed persistence of flubendiamide (Fame 480 SC) on brinjal till 3rd and 7th day after the last spray at 90 (standard dose) and 180 (double dose) g a.i. ha^{-1}. The initial deposits of 0.17 and 0.42 mg kg^{-1} on brinjal fruits reached below determination level of 0.05 mg kg^{-1} on the 5th and 10th day at standard and double dose, respectively. The half life of flubendiamide on brinjal fruits ranged from 2.68 to 2.55 days. Soil samples analyzed on the 15th day after the last spray revealed residues at below determination level (0.05 mg kg^{-1}) at either dose of application.

Das *et al.* (2011) reported that the initial deposits of flubendiamide 39.35 SC were found to be 0.28 and 0.53 mg kg^{-1} in/on okra fruits reached below determination level of 0.01 mg g^{-1} on the 7^{th} and 10^{th} day at 24g a.i. ha^{-1} and 48g a.i. ha^{-1} doses, respectively. The half life ranged from 4.7 to 5.1 days respectively. Gurmail Singh Sahoo *et al*. (2011) determined that when three applications of flubendiamide 480SC @ 48 and 96 g a.i. ha^{-1} at 7 day intervals showed average initial deposits of 0.68 and 1.17 mg kg^{-1}, respectively in chickpea pods, half-life of 1.39, 1.44 days and 0.77, 0.86 days in chickpea pods and leaves respectively. Theoretical maximum residue contribution (TMRC) found to be well below the maximum permissible intake (MPI) on chickpea pods and leaves at 0-day (1 h after spraying) for the both dosages.

Mohapatra *et al.* (2011) reported that the initial residue deposits of flubendiamide on field-treated tomato from treatments @ 48 and 96g a.i. ha^{-1} were 0.83 and 1.68 mg kg^{-1}, respectively. The residues of flubendiamide dissipated at the half life of 3.9 and 4.4 days from treatments respectively and persisted for 15 days from both the treatments.

Paramasivam and Banerjee (2011) reported that the half life of flubendiamide in tomato fruit was 1.64 and 1.98 days in recommended and double dose, respectively. Tomato fruits analyzed on the 10^{th} day after the last spray have not revealed flubendiamide *i.e* below determination level (0.01 mg kg^{-1}). Its metabolite desiodo flubendiamide residues at either dose of application.

Sharma *et al.* (2011) reported that average initial deposits of flubendiamide in chilli as alone or as mixture of thiacloprid combination were almost the same i.e, 0.467 and 0.499 mg kg^{-1} at 60g a.i. ha^{-1} and 0.824 and 0.992 mg kg^{-1} at 120g a.i. ha^{-1} respectively. Residues dissipated to below detectable levels within 7 to10 days, respectively.

Takkar *et al.* (2011) reported that an average initial deposit of 0.33 and 0.61 mg kg^{-1} of flubendiamide 480 SC was observed respectively after three applications at 7 days interval at 90 and 180 g a.i. ha^{-1} in/on brinjal fruits. The residues of flubendiamide dissipated quickly and after 3 days, the extent of dissipation and half life were observed to be about 76 and 79 per cent, 0.62 and 0.54 days at single and double dosages, respectively.

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