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Review on Residues of Profenofos in Pigeonpea Seeds

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Abstract:
Pesticide residue originating from the excessive use of pesticides becomes a permanent danger to quality of food, environment and consumer's health. MRL's are intended primarily as a check that the pesticide is being used correctly through good agricultural practices and also to assist global export in treated produce. In vidarbha region of Maharashtra, profenofos is widely used insecticides belonging to class Organophosphorus group, recommended against control of *Helicoverpa armigera* on pigeonpeas and other crops.Therefore, keeping in view of the above discussions the available literature related to residues of this insecticide in pigeonpea and other vegetable crops has been reviewed.
Key words: Profenofos, Residues, MRL's.

1. Introduction

Pesticides are used to control various kinds of pests and boost agricultural production however, when pesticides are used indiscriminately, they pose danger and risk to human health (Fenik et. al., 2011), cause pollution of soil, water, and air making unstable ecosystem and pest build of resistance to pesticides. Pesticide residues occurring in crops at harvest depends on the initial deposit, its distribution and coverage and secondly on its disappearance after application, both apparent through dilution by crop growth, and real, through the effects of various physical, chemical and biological activities. Since food is the main source of exposure to pesticide its analysis is tremendously an important process in determining the safety of using certain pesticides. Analytical quality requirements like trueness, precision, sensitivity and selectivity have been met to suit the need for any particular analysis .Number of analytical methods are designed to determine multiple pesticide residues. In 2003, the QuEChERS method for pesticide residue analysis was introduced Anastassiades *et al.* [1], which provides high quality results in a fast, easy, an inexpensive approach. Follow-up studies have further validated the method for greater than 200 pesticides .The purpose of pesticide monitoring programs is to ensure that residues in fruits and vegetables do not exceed maximum residues levels (MRLs) allowed by the government, no misuse of pesticides that could result in unexpected residues in food and that good agricultural practices (GAP) are maintained and also to meet the demands by international trade. The use of pesticides varies greatly among different parts of the world in types and quantities. Consequently, many international organizations such as the Codex Alimentarius Commission and European Union as well as different countries have issued their own pesticide maximum residual limits (MRLs) in the international trade.Profenofos (O-(4- bromo-2-chlorophenyl) O-ethyl S-propyl phosphorothioate) is a broad spectrum organophosphate insecticide extensively used for the control of various caterpillars, white fly and mites on cotton and vegetable crops [2](Abdel Razik,.2006) .It is used widely used against *H.armigera* on pigeonpeas. The Codex maximum residue limits (MRLs) for profenofos residues in/on several commodities ranged from 0.01 to 2 mg/kg and 0.05 µg/g on pigeon pea grains.Therefore, keeping in view of the above discussions the available literature is related to the residues of profenofos in pigeonpea and other vegetable crops has been reviewed.

2. **Residues of profenofos in pigeonpea**

Patel *et al.* (2015) [3] conducted a field experiment to study the residues and persistence of acephate, profenophos and triazophos in/on brinjal.Two foliar sprays of acephate, profenophos and triazophos were given at 10-days interval starting from fruit initiation stage @ 560, 500 and 500 g a.i. /ha, respectively resulted in its average residues of 2.436, 1.317 and 1.099 µg/g, respectively in brinjal fruits, one hour after application. The levels thereafter declined steadily and reached BDL on 10th, 15th and 15th day for acephate, profenophos and triazophos, respectively.

Chawla et al. (2015)[4] studied the residues and persistence of acephate, cypermethrin and profenofos in/on green chilli two foliar sprays of acephate, cypermethrin and profenofos were given at 10-day interval starting from fruit initiation stage in green chilli @ 560, 50 & 500 g a.i./ha, respectively. Cypermethrin andprofenophos were detected at levels of 0.305 & 2.94 µg/g respectively in green chilli, one hour after application. The residues of acephate and its metabolite methamidophos were 2.49 µg/g and

0.161µg/g, respectively, one hour after application. The levels of cypermethrin and profenophos decreased steadily and reached BDL on 5th and 10th day, respectively. Acephate decreased steadily till 15 day along with accumulation of methamidophos but did not reach BDL. Levels of methamidophos increased till 10 day of application and thereafter decreased.

Bansode *et al.* (2015)[5] invested on dissipation of organophosphorus insecticides in/on okra. The studies included three organphosphorus insecticides, viz. acephate (500 g a.i/ha), trizophos (500 g a.i. /ha) and profenophos (500 g a.i/ha). Two sprays were given at an interval of 10 days starting at fruit initiation stage. The samples were analysed by QuEChERS method and estimated on GC-MS.The results revealed that acephate, triazophos and profenophos persisted upto 7, 7 and 10 days, respectively after second spray. No residues were detected in the untreated control samples.

Priyadarshini (2015)[6] collected brinjal samples from three local vegetable markets and analyzed for residues .The result revealed that ,monitored samples of brinjal contained 10 pesticide residues namely dimethoate, malathion, chlorpyriphos, profenofos ,cypermethrin,lamda cyhalothrin ,ethion ,Quinolphos, deltamethrin and fenvalerate and the commonly detected pesticides in three markets were profenofos, lamda cyhalothrin, cypermethrin and ethion.(Profenophos 50 EC 2ml/l), cypermethrin (10 EC 0.52ml/l), (lamda cyhalothrin 2.6 % EC, 1ml/l) (ethion 50 WG 2ml/l). The brinjal samples was fortified with profenofos at (0.05, 0.25 and 0.5 mg/kg) .Assessment on the permissibility of three market samples of brinjal for safe consumption was analyzed for different insecticide residues, two of the insecticides chlorpyriphos and cypermethrin have shown above the MRL value established by codex While remaining insecticide residues detected in the sample were below the Maximum residue level

Lu Prado (2015)[7] in study assessed trending of insecticide residues in crop commodities and soil samples. This is a comparative secondary analysis of two sampling periods (2008 and 2010). In 2008, the insecticide residues detected in the soil and crop samples were chlorpyrifos, chlorothalonil, endosulfan sulfate, and profenofos. Of these residues, endosulfan sulfate yielded the highest concentration at 0.095 ppm. In 2010, the residues found in the crop and soil samples were chlorpyrifos, cypermethrin, cyhalothrin, deltamethrin, and fipronil. Of these residues, chlorpyrifos registered the highest concentration at 1.41 ppm. The residues that exceeded the maximum residue limit for soil samples were endosulfan and chlorpyrifos. Meanwhile, chlorpyrifos and cypermethrin were the most frequently detected insecticide residues in the crop samples. Deltamethrin and Profenofos residues did not exceeded the maximum residue limit for soil samples insecticide residues were not detected in the crop samples.

Harinathareddy *et al.* (2015)[8] determined the extent of pesticide residues removal from Grapes through household processing. The pesticides, profenophos 50EC @ 2ml/lit, chlorpyrifos 20EC @ 2ml/lit, dimethoate 30EC @ 4ml/lit, malathion 50EC @ 3ml/lit, phosalone 35EC @ 3ml/lit, quinalphos 25EC @ 2ml/lit, triazophos 40EC @ 2.5ml/lit, lamdacyhalothrin 5EC @ 0.6ml/lit.were sprayed at recommended dose respectively . The residues got substantial reduction by different house hold processing methods such as washing with tap water, 2% salt solution, 2% tamarind solution, Lemon water, baking soda, vinegar, Bio wash (available in market) and cooking, etc.Average residues (mg/kg) in grape sample collected at 2 hrs after spray was found to be Dimethoate (1.689), chlorpyrifos (4.440), Malathion (0.155), phosalone (1.585), quinalphos(0.893), triazophos (1.917), lambda cyhalothrin (2.275) and profenophos (1.396).The codex MRL for profenofos is not available for grapes however the Codex maximum residue limits (MRLs) for profenofos residues in/on several commodities ranged from 0.01 to 2 mg/kg.

Reddy *et al.* (2014)[9] conducted an experiment utilizing the insecticides profenophos 50 EC (1000g a.i.ha-1) and bifenthrin 10 EC (100 g a.i.ha-1) by spraying on cabbage at head initiation stage followed by another spray after 10 days and the samples were collected at. 0, 5, 10, 15 and 20 days after last spray and analyzed. The initial deposits of 0.99 mg kg-1 profenophos recorded at 2 hours after last spray dissipated to 0.16 mg kg-1 by 5 days and below determination level (BDL) by 10th day. By removing outer top three layers the initial deposits of 0.08 mg kg-1 profenophos recorded at 2 hours after last spray dissipated to below determination level (BDL) by 5th day. The initial deposits of 2.24 mg kg-1 of bifenthrin recorded at 2 hours after last spray dissipated to 0.82 mg kg-1 by 5 days after last spay and below determination level (BDL) by 10th day. By removing outer top three layers the initial deposits of 1.66 mg kg-1 of bifenthrin recorded at 2 hours after last spray dissipated to below determination level (BDL) by 5th day.

Brar (2013)[10] studied the persistence of residues on brinjal fruits and recorded initial deposit due to single dose of profenofos (500 g a.i. /ha) as 1.966mg/kg, however at double dose (1000 g a.i. /ha) deposit was 2.460 mg/kg. The initial deposit of 0.950 mg/kg at single dose and 1.423 mg/kg at double dose was observd for profenophos in brinjal cropped soil. Profenofos residue persisted upto 7 and 10 days at single and double dose. The residues of profenofos in fruits reduced to half in less than 2 days .

Venkataiah (2013)[11] in his studies on eight insecticides Flubendiamide @ 24 g a.i. ha-1 , Profenophos @ 500 g a.i. ha-1 and lambda-cyhalothrin @ 15.63 g a.i. ha-1 , emamectin benzoate @ 9.50 g a.i. ha-1 , chlorantraniliprole @ 30 g a.i. ha-1 ,Novaluron @ 100 g a.i. ha-1, indoxacarb @ 63.20 g a.i. ha-1 and Spinosad @ 75 g a.i. ha-1 revealed that Profenophos 50 EC @ 500 g a.i.ha-1 recorded the initial deposits of 0.33 mg kg-1 after third spray on green pods. The residues recorded at 1,3 and 5 days after spraying were found to be 0.20, 0.11 and 0.02 mg kg-1 , respectively on green pods with 39.39, 66.67 and 93.94 per cent dissipation respectively on green pods. After 7 days the residues were below detectable level (BDL) showing 100 per cent dissipation on green pods. The dry pods at harvest were free from the residues of profenophos.

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Parmar and Korat (2012)[12] studied dissipation and decontamination of deltamethrin, alphamethrin, deltamethrin (in combination), triazophos, ethion, cypermethrin and profenophos residues were in/on okra fruits at middle Gujarat region, India .The samples were procured up to 7 d after application of pesticides . The average initial deposit of deltamethrin, alphamethrin, deltamethrin in combination, triazophos, ethion, cypermethrin and profenophos was 0.152, 0.136, 0.025, 0.543, 0.254, 0.172 and 4.519 mg kg−1, respectively which dissipated to 0.025 (83.55%), 0.023 (83.09%), 0.010 (60.00%), 0.015 (0.015%), 0.013 (94.88%), 0.020 (88.37%) and 0.508 (88.76%) mg kg−1 on 5th and 7th d. The half-life values for respective pesticides were 2.09, 2.09, 2.61, 1.68, 1.27, 2.59 and 1.88 d, respectively.

Conclusion:

There is a potential for the intake of residues from contaminated food and can result in situations posing health risks to human and other forms of the life. The review study showed that the use of profenofos in recommended doses will minimize the accumulation of residues in edible plant parts.The risk factors can be greatly minimized or even eliminated if pesticides are selected properly and used judiciously following Good Agricultural Practices (GAP).

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