Ecofarming
e-Magazine for Agriculture and Allied Sciences
http://www.ecofarming.rdagriculture.in
e-ISSN: 2583-0791

Decontamination

Methods for Insecticide Residue in Vegetable crops

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Received: August, 2024; Accepted: September, 2024; Published: October, 2024

Introduction

Vegetables are sources of essential biochemicals and nutrients being a basic source of energy for human beings in developing countries. Vegetables are major constituents for diet as majority of Indians are vegetarian with per capita consumption of 135 g/day. India is the second largest producer of vegetables next to China and accounts for about 13.08% of gross cropped area (192 Mha) and contributes 30% to agricultural GDP of India, shares 37% of total exports of Agricultural Commodities. In Gujarat, they are grown in 626.26 thousand hectares with the productivity of 20.04 tones/ha (Suvagiya *et al*., 2017). Vegetables are giving better return over investment to the farmers however, several factors limit their productivity, mainly insect pests and diseases resulting in average production losses to the extent of about 25% (Deuri*et al*., 2019). Hence, in order to combat the insect pest problem, insecticides/pesticides are repeatedly applied with over dose during the entire period of growth and sometimes at fruiting stage also by the vegetable growers for better yield and quality. Indiscriminate use of pesticides particularly at fruiting stage and non-adoption of safe waiting period leads to accumulation of pesticide residues in consumable vegetables and these residues are causing chronic disorders to the human health when consume without processing. Hence, it is necessary to remove or minimize the level of residue (< MRL) in vegetables before it consume.

Kumari (2008) revealed that washing reduced 21.00 to 77.00 per cent and boiling reduces 37.00-100.00 per cent residues of organochlorines, synthetic pyrethroids, organophosphates and carbamates from brinjal fruits. Maximum (100%) reduction of OP insecticides was observed in brinjal followed by 92.00 per cent in cauliflower and 75.00 per cent in okra by boiling method. Boiling method was found comparatively more effective than washing in dislodging the insecticides residue.

Thanki *et al.* (2012) indicated that washing, boiling and cooking processes minimized the residue of nine pesticides in the range of 3.32-

70.00, 21.08-70.67 and 31.63-85.30 per cent, respectively from cauliflower.

Abdala *et al*. (2013) found that three times washing of tomato fruits was more effective compare to single wash for reducing the fenpropathrin, lamda-cyhalothrin and deltamethrin residues. Washing, boiling and cooking processes considerably minimized the residue of the eight pesticides from bitter gourd and among them cooking process was found the best process to dislodged the pesticide residues in the range of 22.39-94.64 per cent (Joshi *et al.*, 2015).

Raghu *et al.* (2015) studied on different methods of decontamination like tap water, 2% salt solution, 0.1% baking soda solution, 4% acetic acid solution and veggy wash to remove phosalone residue from chilli fruits and found that the veggy wash proved to be the best practice and removed the highest percentage (78.38 %) of phosalone residue.

Sheikh *et al.* (2015) found that sun drying and dehydration methods were the most effective in reducing the bifenthrin residue from onion followed by cooking in oil (fired).

According to Thanki *et al*. (2015), washing, boiling and cooking processes minimized the residues of eight insecticides in the range of 3.32-70.00, 21.08-70.76 and 31.63-85.30 per cent, respectively from cauliflower.

Vemuri *et al*. (2015) revealed that cumulative effect of household processes like tap water wash, cooking, 2% salt water wash and 2% salt water wash + cooking was caused substantial reduction in residues up to 47.00-100.00 per cent. However, 2% salt water wash + cooking reduced insecticides in the range of 98.02-100 per cent from brinjal fruits.

Patel *et al*. (2016) reported that washing with tap water as well as cooking for 10 minutes found to be the best process for removal of deltamethrin and cypermethrin residues from brinjal fruits up to BDL from brinjal fruits.

Kelageri *et al*. (2017a) found that veggy wash (55.16%), 2% salt solution (47.62%) and 4% vinegar solution (51.98%) proved effective in removal of phosalone residues from tomato fruits. Veggy wash process was found most efficient by removing pesticides residues in the range of 55.16-76.34 per cent in tomato fruit followed by 4% acetic acid solution (52.38-71.52%), 2% salt solution (40.00-53.78%), 0.1% baking soda solution (38.46-51.91%) and tap water (17.78-37.75%) (Kelageri *et al*., 2017b). Also, veggy was found to be very effective in removing lambda-cyhalothrin residues to an extent of 68.87 per cent from tomato fruits followed by 4% acetic acid solution (59.31%) and 2% salt solution (48.02%) (Kelageri *et al*., 2017c).

Patil *et al*. (2018) revealed that the cooking of brinjal fruits showed 89.58 and 89.58 per cent reduction in dislodging the residues of profenophos and triazophos, respectively from brinjal fruits. Washing under running tap water for 2 min. resulted in the maximum removal of 67.09, 70.41 and 73.75 per cent profenophos, trizophos and ethion residue, respectively in okra fruit (Yadav and Shah, 2018).

Rani *et al*. (2019) revealed that 2% salt solution + boiling method had greatest efficiency in residue removal effect for bifenthrin (47.8%),

deltamethrin (72.9%), hexaconazole (36.7%), lambda-cyhalothrin (60.8%) and profenophos (60.2%) in chilli fruit.

Bhilwadikar *et al*. (2019) reported that 99.26 and 75.00 per cent profenophos residue was removal from eggplant with washing and blanching treatments, 100 per cent removal of chlorpyrifos from cauliflower with peeling treatment whereas, 3.40, 3.10 and 3.60 percent removal of chlorpyriphos, cypermethrin and chlorothalonil residue from cabbage. In refrigeration at 4°C for 48 hrs, 60.90, 80.40, 83.30, 66.70, and 70.40 per cent removal of trichlorfon, dimethoate, dichlorvos, fenitrothion and chlorpyrifos residues, respectively in cucumber.

Pooru *et al*. (2019) revealed that dipping of amaranth leaves in 2% tamarind, 1% veggy wash + cooking and 2% common salts processes were found to be effective in removal of 65.33, 65.05 and 65.87 per cent synthetic pyrethroid insecticides, respectively.

Anon. (2020) recorded significantly higher reduction of acetameprid (39.96%) was found in washing with tap water for 13 min. followed by ozonated water washing for 3 min. (39.49%) and wash with ozonated water for 8 min. (39.18%) from okra fruits. While significantly highest reduction of ethion (59.29%) with ozonated water for 3 min. washing from chilli fruits.

Conclusion

Extents of decontamination of pesticides residues from vegetables are vary with household and chemical processes, nature of pesticides and type of vegetables. The selection of process depends on its cost and time and feasibility. From views and results of different research workers, it can be concluded that at least 3 time washing of vegetables with tap water or dipping the vegetables in tap water for at least 30 minutes are the best processes in present situation in minimizing surface pesticides residues below MRL level as it is cheap, fast and feasible at all the places in any situation. While, to remove surface as well as absorbed pesticides residues below MRL level from vegetables, peeling and washing, boiling and cooking are the best methods. Washing with common salt solution and refrigeration methods are also preferable but they are costly and time consuming methods. Veggy wash and wash with ozonated water are also good methods but it require special type of solution which is not available at all the places and cost is inhibiting factors.

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