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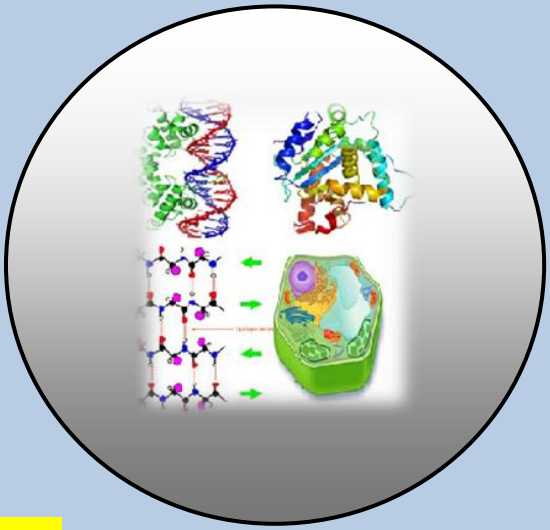

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# Indiscriminate Pesticide use in Vegetable Crops at Bakshi Ka Talab Tehsil of District Lucknow: Frequency and Intensity

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**ABSTRACT**

***The purpose of this study was to assess the agricultural deficits and status of pesticide application frequency in the Bakshi ka Talab tehsil of Lucknow district in Uttar Pradesh. This paper has examined pesticide used by the farmers and their application frequency in four important vegetable crops of this tehsil, viz., okra, chillies, brinjal and tomato. The okra crop was found heavily infested with Helicoverpa armigera, Spodoptera spp and Earias spp. The damage was found up to 90% due to these pests in villages studied. On an average, pesticide application frequency was found to be 13, 11, 7 & 15 in brinjal, chillies, tomatoes and okra crops, respectively. This study was supported by the findings of Indian Institute of Toxicological Research (Srivastava et al., 2011) in which pesticide residues were found above maximum residue level in cauliflower, cabbage, tomato and okra. The study has suggested that for reducing hazardous pesticide-use which are banned by Central Insecticide Board, farmers need to be educated about different non- chemical control methods and should be encouraged to adopt integrated pest management (IPM) practices.***
***Key words: Bakshi Ka Talab, Lucknow, Pesticide Pattern and Vegetable Crops.***

## INTRODUCTION

Pesticides play a significant role in sustaining vegetable production by keeping pest population below economic threshold level. The average pesticide consumption in India is around 0.381 kg a.i./ha as compared to world average of 0.5 kg a.i./ha. Around 13-14 per cent of the total pesticides used in the country are applied solely on vegetables. Among different vegetable crops the maximum pesticide usage are found in chilli (5.13 a.i kg /ha)

followed by brinjal (4.60 a.i kg /ha), cole crops (3.73 a.i kg /ha) and okra (2-3 a.i kg /ha) (Kodandaram *et al*., 2013).

The present share of Uttar Pradesh in total horticulture production of the country is approximately 26%. U.P ranks third in fruits, second in vegetable and first in potato production. The present share of Uttar Pradesh in total horticulture production of the country is approximately 26%.The major vegetables grown in the state are peas, chillies, okra, tomato, brinjal, cauliflower, cabbage, spinach, melon, radish, carrot, turnip and cucurbits. Apart from stagnation in growth in agriculture, a trend of a lower growth continued to haunt the states. Bakshi Ka Talab is an area situated at North side in Lucknow district. Selection of BKT is based on agriculture being the mainstay of majority of the villagers and also reflected in higher cropping intensity. There is a great problem of farmers to manage insect pests to protect their vegetables and fruits. Vegetables are highly perishable products specially during harvesting.

The green revolution resulted in significant enhancement in food production but with insufficient apprehension for agricultural sustainability. Excessive reliance on chemicals for future agricultural sustainability would mean additional loss in soil productivity, increase water contamination and human health hazards.

The aim of this paper was to be acquainted with farmers' pest management practices in four important vegetable crops, viz. chillies, tomato, brinjal and okra in the Bakshi ka Talab Tehsil, District Lucknow.

## MATERIAL AND METHODS

**Table. 1 Distribution of the sample farmers in Bakshi ka Talab Block.**

| Villages selected | Total no. of respondents | Number of respondents growing | | | |
|---|---|---|---|---|---|
| | | Chillies | Brinjal | Tomato | Okra |
| Majhuria | 10 | 1 | 2 | 1 | 6 |
| Bhauli | 10 | 1 | 0 | 2 | 7 |
| Mal road Itaunja | 10 | 1 | 4 | 1 | 4 |
| Kalyanpur | 5 | 1 | 0 | 0 | 4 |
| Prithvipur | 5 | 1 | 2 | 0 | 2 |
| Van Gaon | 5 | 1 | 1 | 1 | 2 |
| Ahladpur | 5 | 1 | 2 | 1 | 1 |
| Paikaramau | 10 | 2 | 0 | 0 | 8 |
| SitaRam Mayka | 5 | 1 | 3 | 0 | 1 |
| Sonikpur | 5 | 1 | 1 | 1 | 2 |
| Maankheda | 5 | 0 | 0 | 1 | 4 |
| Vijaipur | 5 | 2 | 0 | 0 | 3 |
| Naguamau | 10 | 2 | 2 | 1 | 5 |
| Raudahi | 10 | 1 | 2 | 1 | 6 |
| Vishrampurva | 5 | 1 | 0 | 1 | 3 |
| Choti Devraikala | 5 | 1 | 3 | 0 | 1 |
| Bhikhapurva | 10 | 2 | 0 | 1 | 7 |
| Total respondents = | 120 | 20 | 22 | 12 | 66 |

This study was undertaken to evaluate the pesticide used and intensity of different pesticides in vegetable growing areas at Bakshi ka Talab block of Lucknow District in Uttar Pradesh. Okra (*Abelmoschus esculentus*), chillies (*Capsicum annuam*), tomato (*Solanum lycopersicum*) and brinjal (*Solanum melongena L*) were the four vegetables considered for the study. These four crops were frequently sprayed with pesticides due to higher pest incidence of *Helicoverpa armigera*, *Spodoptera litura, Alternaria* disease and viral infections.
The sample block of Bakshi ka Talab from Lucknow district was selected, as the selected vegetables are extensively grown in this region. In the second stage, seventeen villages were selected, and five to ten farmers from each village depending upon crops grown were selected randomly making a total sample size of 120 for the study.
Among the 120 sample farmers, chillies, tomato, brinjal and okra were grown by 20, 12, 22 and 66 farmers, respectively (Table 1).

| Marginal farmers (%) | Average farm of marginal farmers (ha) | Small farmers (%) | Average farm of small farmers (ha) | Large farmers (%) | Average farm of large farmers |
|---|---|---|---|---|---|
| 82 | 0.46 | 29 | 1.24 | 9 | 2.75 |
| Total = 120 | | | | | |

## RESULTS

**Socio-economic impact of indiscriminate use of pesticide**

The study clearly indicates that small or marginal farmers at Bakshi Ka Talab, Lucknow were practicing intensive agriculture and not bothered or conscious about the deleterious effects of chemical pesticides and their spray application techniques. The farmers, both small holders and big farm holders, were concerned only in maximising their yields.

**Table: Socio economic profile of sample farmers**

The average farm size of the sample farmers was found 0.46 ha to 2.75 ha and vegetables were the major crops grown in the sample farms. Around 68 % cultivars are having lowest land holding size (below 0.5 hac).
Knapsack spraying is used for spraying cereals and vegetables crop in this region. The farmers were unaware about the waiting period of pesticides, their lethal dose toxicity, persistency or recommended package of practices of horticultural crops recommended by the agriculture department. It was observed that chemicals were applied without sufficient understanding of pest habitat, economic injury level, pesticide chemistry, their quantities and application strategies. This also includes non-protective work practices followed by farmers and farm workers during spraying.
According to many farmers (82%), they were faced with continuous reduction in their returns due to increase in inputs/ reducing or stagnant prices of their products.

**Frequency of Pesticides Application**

In vegetables, pesticides were frequently used because pest infestation was relatively high in chillies, tomato, brinjal and okra. Pesticide name and frequency of application by farmers is presented in Table 2.

Harvesting of the vegetables (picking) was done once in 15 days in chillies, once in five days in brinjal & tomato and on alternate days in okra. As pesticide spray was done immediately before harvesting; no waiting period was observed. Since pest-free healthy produce fetched higher price in the market, frequency of pesticide spray was found more in the above four crops. Thus, the threat of pesticide residue on farm produce was more. Lack of data on pesticide exposure assessment is another limitation in this study.

Frequency distribution in farms is presented in Table 4 for different vegetables. The pesticide application to okra crop was more than the other three crops. Farmers applied 6-18 pesticide applications for controlling borers (*Helicoverpa* spp, *Earias* spp and *Spodoptera* spp) in okra.

About 25.05 per cent of the farmers had an average of 13 or less sprayings, while 64 percent gave 14-18 sprayings to protect their produce from insect pests. Study revealed that 77. 95 per cent of the farmers used more than 4 kg of active ingredient (a.i /ha) of technical grade insecticide.

In tomato, the number of application frequency ranged from 4 to 10 during the whole crop period. Majority of fields were found infected with fungal diseases, viz, *Fusarium* spp and *Alternaria* leaf spot, etc. About 68.31 per cent of tomato growers applied fungicides (Carbandazine,Thiram, Mancozeb, Sulfex and Bevastin) amounting to 2 kg or less of a.i/ha.

In brinjal, the frequency of insecticide spraying ranged from 10 to 13 to manage brinjal borer. The minimum range of pesticide-use quantity in brinjal was found to be 3-4 kg a.i/ha.

The frequency of applications in chillies is found lowest (1-2 spraying). High viral infection was observed in chillies and majority of farmers (89%) were unaware of mode of transmission of this disease.

The results clearly indicate that highest pesticide application frequency was observed in okra followed by brinjal, tomato and chillies. In okra, even though frequency of pesticide applications was high, waiting period was found lowest (less than 24 hrs).

**Table 2. Frequency of pesticide used in different vegetables**

| **Frequency of pesticide application** | **Percentage of farmers applying pesticides** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Okra** | **Amount of technical ingredient (a.i. per ha)** | **Tomato** | **Amount of technical ingredient (a.i. per ha)** | **Brinjal** | **Amount of technical ingredient (a.i. per ha)** | **Chillies** | **Amount of technical ingredient (a.i. per ha)** |
| **1-2** | 0.00 | | 0.00 | | 0.00 | | 100 | 0.5 kg |
| **≤ 4** | 0.00 | | 68.31 | < 2kg | 0.00 | | 0.00 | |
| **≤ 6** | 4.88 | | 21.69 | | 0.00 | | 0.00 | |
| **< 10** | 6.94 | < 2 kg | 10.00 | | 10.42 | | 0.00 | |
| **10** | 10.23 | | 0.00 | | 46.89 | 3- 4 kg | 0.00 | |
| **13** | 13.95 | | 0.00 | | 42.69 | | 0.00 | |
| **> 15** | 20.56 | > 4 kg | 0.00 | | 0.00 | | 0.00 | |
| **18** | 43.44 | | 0.00 | | 0.00 | | 0.00 | |

**Table. 3 Pesticides used by vegetable growers at Bakshi Ka Talab and their toxicity status.**

| Pesticide use by the farmers | Category (WHO) | LD50 mg/kg | Remarks | MRL or Tolerance Limit in mg/kg (ppm) PFA (Indian) | Predominant pesticide residues found in food commodities above PFA (April 2008 to March 2009) |
|---|---|---|---|---|---|
| **Methyl Parathion 50%EC & 2% EC** | Class I A | 14 | Extremely hazardous Methyl Parathion 50 % EC and 2% DP formulations are banned for use on fruits and vegetables. (S.O.680 (E) dated 17thJuly, 2001) | | **According to All India Network Project "Monitoring of Pesticide Residues at National Level"** Aldrin, **Chlorpyriphos,** Dichlorvos, Phorate, Chlordane, Chlorfenvinfos, DDT-T, **Monocrotophos, Endosulfan-T** **Crops** Cauliflower, **brinjal**, cabbage, bitter guard, **tomato**, **okra**, banana, apple, orange, wheat, rice |
| **Dichlorvos** | Class I B | 56 | Highly hazardous | 0.15(Cucurbits/ Vegetables) | |
| **Carbofuran 3%G** | Class I B | 8 | Highly hazardous | 0.10 (Fruits & Vegtables) | |
| **Monocrotophos** | Class IB | 14 | Highly hazardous Monocrotophos is banned for use on vegetables. (S.O.1482 (E) dated 10thOct, 2005) | | |
| **Trizophos** | Class IB | 82 | Highly hazardous | 0.2 (Chilli) | |
| **Profenofos 50% EC** | Clas II | 358 | Moderately hazardous | | |
| **Cypermethrin 25% EC & 10% EC** | Class II | 250 | Moderately hazardous Cypermethrin 3 % Smoke Generator, is to be used only through Pest Control Operators and not allowed to be used by the General Public. [Order of Hon,ble High Court of Delhi in WP(C) 10052 of 2009 dated 14-07-2009 ) | 0.20(Brinjal) 2.0(Cabbage) 0.20(Okra) | |
| **Chlorpyriphos** | Class II | 135 | Moderately hazardous | 0.01(Cabbage) 0.2 (Other Vegetables) | |
| **Acephate 75% SP** | Class III | 945 | Slightly hazardous | | |
| **Thiram** | Class III | 560 | Slightly hazardous | | |

| | | | | | |
|---|---|---|---|---|---|
| **Mancozeb** | | >8000 | Unlikely to present acute health hazards in normal life | 3.0 (Tomato), 1.0 (Chilli), 0.02 (Cauliflower) | |
| **Endosulfan 35% EC** | Class II | 80 | Moderately hazardous **banned** | 2.0 (Fruits & Vegetables) 1.0 (Chilli) | |
| **Carbendazin** | | >10000 | Unlikely to present acute health hazards in normal life | 0.50 (Vegetable) | |
| **Imidacloprid** | Class II | 450 | Moderately hazardous | | |

**Types of Pesticide Used**

The farmers at Bakshi ka talab were using all the groups of pesticides including organophosphate, organochlorine, pyrethroids, bio-fungicides excluding bio-insecticides. Since insect attack was severe than fungal attack in okra, maximum pesticides applications was recorded in this crop (Table: 3). Most of the pesticides, Methyl parathion, Dichlorvos, Carbofuron, Monocrotophos and Trizophos, used on the vegetable crops are categorised as extremely hazardous chemicals by WHO recommended classification of pesticides by hazards, 2005 based on acute dermal LD50 for Rats (Table:3). Highly hazardous pesticides such as Dichlorvos, Carbofuran, Maonocrotophus and Triazophos were frequently applied by the farmers. Cypermethrin, Profenophos, Trizophos, Chlorpyriphos and organochlorine Endosulfan, which is now banned by the Central Insecticide Board, were the most frequently used pesticides in okra and brinjal. Imidacloprid was the most frequently and repeatedly used pesticide in chillies and cauliflower.

## DISCUSSION

This study support the findings of National Accreditation Board for testing and Calibration Laboratories (NABL) accredited pesticide residue testing laboratory, Pune which reported pesticides residues in vegetable samples (capsicum, potatoes, tomatoes, cucumber, etc.) collected from market (upto 181 ppb level). Study was conducted at Indian Institute of Toxicological Reseach, Lucknow on 20 vegetables including capsicum, okra, tomato, potato, etc, which revealed that pesticides such as HCH, Endosulfan, Dichlorvos, Permethrin, Malathion and Diazinon were detected from samples. In some vegetables like radish, cucumber, cauliflower, cabbage and okra, the detected pesticides were above maximum residues limit (PFA) (Srivastava *et al*., 2011) (Table 3). Similarly, 100% vegetable samples from Kanpur, Lucknow and Allahabad were found contaminated by Kaphalia *et al.,* 1990. Unprompted urban and industrial developments in this region have extensively contributed to the elevated levels of pesticide residues (Khairaih *et al.,* 2004 and Sharma *et al.,* 2008). Farmers need to be educated about sustainable agriculture management practices and encouraged to adopt practices which manage the insect pest along with conservation of natural enemies. Also, there is need of in-depth farmer's training programme on integrated disease and insect management strategies in vegetables in these areas. The results found in the current study suggest a great deal of monitoring and immediate measures to address this issue with respect to economic and health perspective of the studied area.

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