



Knowledge and Impression of Fenugreek Growers about Insecticide Usage in District of Western Maharashtra, India

S. S. Shinde^{a+++*}, C. S. Patil^{a#}, B. V. Deore^{a†} and S. A. Pawar^{b‡}

^a *Department of Agricultural Entomology, MPKV, Rahuri-413722, India.*

^b *Department of Horticulture, MPKV, Rahuri-413722, India.*

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

A survey was done in the Western Maharashtra districts, Ahmednagar, Pune, and Nashik to investigate the pesticide usage pattern in fenugreek from 2019 to 2020. The total 150 fenugreek growers were chosen at random and interviewed out of that, fifty growers were from each selected district. The collected data was analysis with the help of excel to calculate per cent respondents. In accordance with the survey, the majority of fenugreek growers (52.00%) used novel insecticides, followed by conventional (39.25%) and biopesticides (8.75%). In terms of knowledge and farmer perception, 63.33% of farmers were conscious of the seriousness of insect pest problems in fenugreek, well almost 60.66% were aware of natural enemies, 66.66% were aware of the benefits

⁺⁺ *Ph.D. Scholar;*

[#] *Head;*

[†] *Residue Analyst, AINPPR;*

[‡] *Entomologist;*

^{*} *Corresponding author: E-mail: researchsojwal@gmail.com;*

of employing biopesticides, and only 28.00% of fenugreek growers were aware of the harmful effects of insecticides and failed to take any precautions to avoid harmful effects. The majority of farmers were unaware of the acceptable waiting period for harvesting fenugreek after application of insecticides.

Keywords: Neonicotinoids; diamides; organophosphate; biopeptides; fenugreek; natural enemies.

1. INTRODUCTION

Fenugreek, also known as *Trigonella foenum-graecum*, is an herb that has been used for centuries for both culinary and medicinal purposes. This herb is native to the Mediterranean region and is now grown worldwide, including in India, North Africa, and the Middle East. Fenugreek is highly valued for its nutritional and health benefits, as well as for its unique flavour and aroma (Zandi et al., 2017).

“Modern research has also demonstrated that fenugreek seed and leaves are useful in the treatment of a number of diseases including successfully reducing blood sugar and blood cholesterol levels in both animals and human subjects in experimental trials” [1]. “Fenugreek is therefore highly sought after as a chemurgic crop in the local, regional and international pharmaceutical, nutraceutical and functional food industries and markets as a medicinal herb” [2].

India is the largest producer of fenugreek in the world, accounting for more than 80% of the global production. The area under fenugreek cultivation in India is estimated to be around 1,26,000 hectares [3].

The major fenugreek producing states in India are Rajasthan, Gujarat, Uttar Pradesh, Madhya Pradesh, Maharashtra, and Haryana. Rajasthan is the largest producer of fenugreek in India, accounting for more than 80% of the country's total production [4].

A diverse range of sucking pests, including aphids, thrips, leaf miners, and other insect pests, attack green vegetables [5]. In the fight against these pests, fenugreek growers mostly used pesticides. Farmers now primarily use novel as well as traditional insecticides since they are commonly available and extremely effective. Nevertheless, there are presently no pesticides registered and recommended by CIB and RC to manage fenugreek pests [6].

“Farmers frequently use non-recommended insecticides, a higher dose than recommended,

not sticking to the prescribed waiting period, use of sub-standard pesticides, improperly disposed of leftover and cleaning of plant protection equipment, and pre-marketing pesticide application as the reason for elevated pesticide residues on vegetables in India” [7].

“The ongoing use of pesticides to manage pests and disease vectors has a deleterious impact on non-target organisms in addition to leaving residues in the environment. As a result, the dangers of pesticides have overshadowed their benefits, prompting the research for alternatives” [8]. Chemical pesticides are more detrimental in vegetables.

In modern agriculture farmer are seeking to get more yield and the main threat are insect pests, to get rid from this they indiscriminately used insecticide in modern agriculture which is a today's alarming situation. It not only deteriorates the soil fertility but also adversely affect the soil-water-plant- microorganisms as well as human column. Hence the present investigation is quite relevant to current situation. As result, the goals of this research were to document the intensity, farmer perspectives, and various pesticides used by farmers in fenugreek cultivation as they consume raw and fresh.

2. MATERIALS AND METHODS

During 2019-20, a field survey was conducted in the Western Maharashtra districts viz., Ahmednagar, Nashik, and Pune. The quaternary structure was used for this purpose. Total 150 fenugreek growers were chosen at random and interviewed out of that, fifty growers from each selected district. The questionnaire (Table 1) had closed and multiple-choice style items with Yes/No answers. The interviews were conducted in the appropriate local language, Marathi. The total 150 fenugreek growers were surveyed during the study to know the insecticide usage pattern. All obtained information of 150 growers was assembled into an appropriate format, thoroughly examined, and compared for their knowledge and impression of insecticide use, for that purpose the per cent calculation was done with simple excel sheet.

Table 1. Prepared questionnaire for collecting the data on insecticides usage pattern [9]

S.N.	Particular	Answers Yes/No
1	Name of Farmer	
2	Address	
3	Season	
4	Total cultivable land	
5	Area under leafy vegetable (Spinach)	
6	Area under others crop	
7	Pest occurrence	
8	Insecticides used against aphids and leaf miner	
9	Name of insecticide	
10	Volume of spray	
11	Frequency of spray	
12	Information on application of Biopesticides (if any)	
13	Do you know about natural enemies?	
14	Do you know about recommended pesticides in leafy vegetables?	
15	How do you measure pesticides (bottle/ top approximately)?	
16	How do you mix the pesticides in the water –bare hand/sticks?	
17	Source of information for recommended pesticides – Agril. Dept/ Neighbors/Media / Dealers/Scientists/University.	
18	Do you know safe waiting period?	
19	Do you know about effects of pesticide residue?	
20	Signature of farmer and Date	
21	Signature of Surveyor and Name	
22	Mob. No. of Farmer	

3. RESULTS AND DISCUSSION

1. Usage pattern of insecticides in fenugreek in western Maharashtra

The survey's main objective was to obtain data on Western Maharashtra's pesticide

consumption patterns. Based on the information collected and summarized in Table 2 novel insecticides comprised (52%) of the insecticides applied by fenugreek growers, followed by conventional insecticides (39.25%) and biopesticides (8.75%) (Figs. 1 & 2).

List 1. Sample size

Sr. No.	Name of the districts	Sample size
1	Ahmednagar	50
2	Pune	50
3	Nashik	50
Total sample size		150

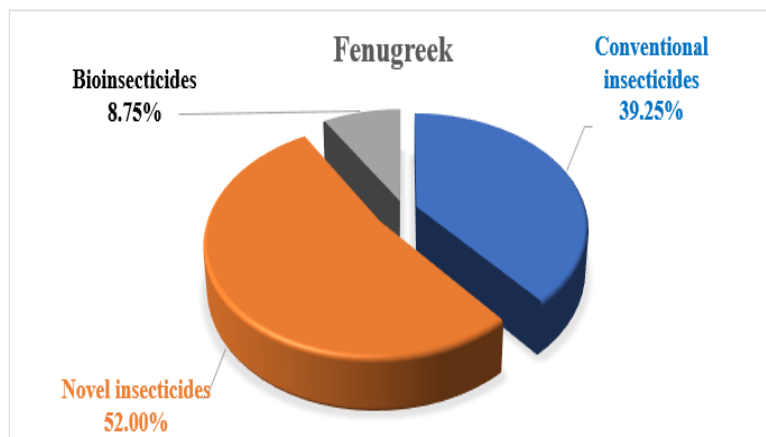


Fig. 1. Insecticides usage in Ahmednagar, Pune and Nashik districts

Table 2. Insecticide usage pattern of Fenugreek in Western Maharashtra

Sr. No.	Major group of insecticides	Chemical group	Per cent share insecticides used by individual growers		
			Ahmednagar	Pune	Nasik
1.	Conventional insecticides (39.25 %)	Organophosphates	29.92	26.76	27.81
		Carbamates	3.94	3.49	2.37
		Pyrethroids	4.72	9.88	8.88
		Total	38.58	40.13	39.06
2.	Novel insecticides (52.00 %)	Neonicotinoids	28.35	24.42	23.67
		Diamides	25.20	23.84	25.44
		Phenyl Pyrazole	1.57	1.16	2.37
		Total	55.12	49.42	51.48
3.	Bioinsecticides (8.75 %)	Azadirachtin	1.57	2.91	2.96
		Nimbecidine	4.72	7.56	6.52
		Total	6.29	10.47	9.48

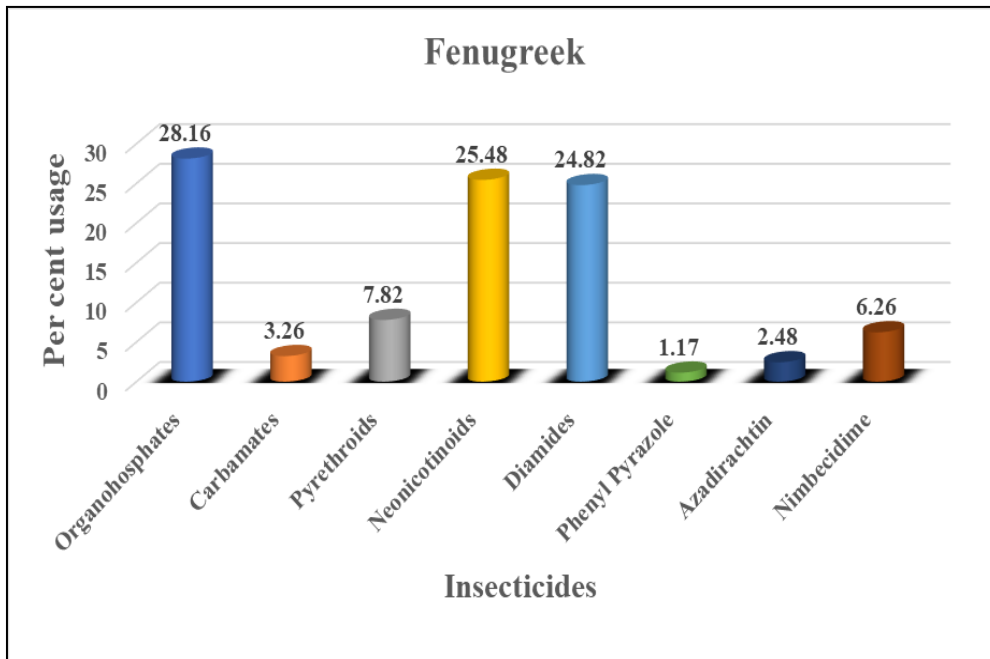


Fig. 2. Group wise insecticides usage in Ahmednagar, Pune and Nashik districts (% share in total usage)

Table 3. Awareness of farmers about pest management in fenugreek (% respondents)

Sr. No.	Particulars	Ahmednagar	Pune	Nasik	Mean
1.	Awareness about pest problems	64.00	61.50	64.50	63.33
2.	Awareness about natural enemies	54.00	64.00	64.00	60.66
3.	Awareness about biopesticides	56.00	74.00	70.00	66.66
4.	Awareness about recommended insecticides in fenugreek	00.00	00.00	00.00	00.00
5.	Awareness about the effects of insecticides residues	30.00	28.00	26.00	28.00

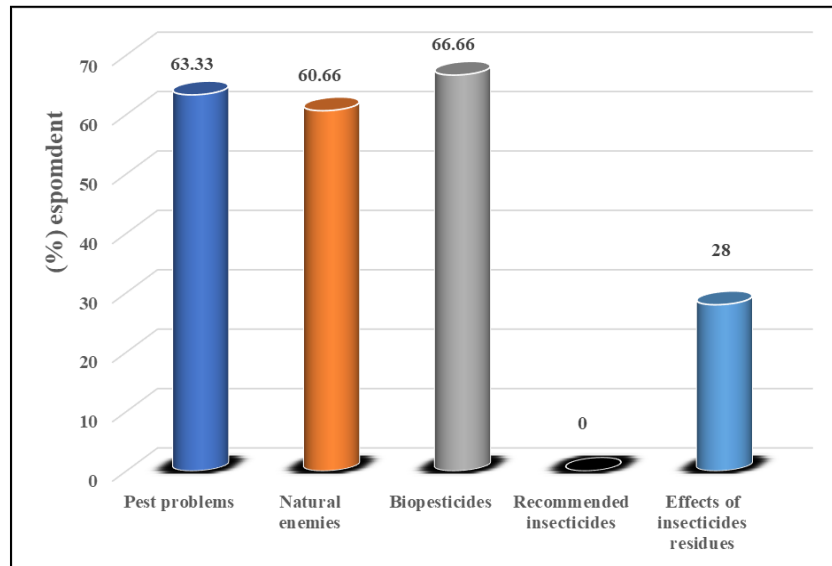


Fig. 3. Awareness of fenugreek growers (% respondents)

2. Ahmednagar district

Novel insecticides (55.12%) were found to be the most widely utilised by fenugreek growers in the Ahmednagar district, followed by conventional (38.58%) insecticides and biopesticides (6.29%). Among conventional pesticides, organophosphates (29.92%) use to have a higher share than pyrethroids (4.72%), and carbamates (3.94%). The percentage of neonicotinoids (28.35%) in new insecticides was higher than that of diamides (25.20%) and phenyl pyrazole (1.57%) insecticides. To some extent, neem-based treatments such as nimbecidime (4.72%) and azadirachtin (1.57%) were applied (Figs. 1 & 2).

3. Pune district

Novel insecticides (49.42%) were found to be the most commonly applied by fenugreek growers in the Pune district, followed by conventional insecticides (40.13%) and biopesticides (10.47%). Also, organophosphates (26.76%) had a higher share than pyrethroids (9.88%) and carbamates (3.49%) insecticides. 63 The percentage of neonicotinoids insecticides (24.42%) in new insecticides was higher compared to diamides (23.84%) and phenyl pyrazole (1.16%). Nimbecidime (7.56%) and azadirachtin (2.91%), both derived from neem, were applied to large extend (Figs. 1 & 2).

4. Nashik district

Novel insecticides (51.48%) were found to be the most commonly applied by fenugreek growers in the Nashik district, followed by conventional

(39.06%) insecticides and biopesticides (9.48%). Among conventional pesticides, organophosphate (27.81%) had a higher share than pyrethroids (8.88%) and carbamates (2.37%). Diamide insecticides (25.44%) used to have a higher share in new insecticides than neonicotinoids (23.67%) and phenyl pyrazole (2.37%). To some extent, neem-based products such as nimbecidime (6.52%) and azadirachtin (2.96%) were applied (Figs. 1 & 2).

The aforementioned results correspond to prior studies. In the Belagavi area of Karnataka, an average pesticide usage of 0.563 g a.i. ha⁻¹ was found in cabbage [10]. Insecticide usage was found to be 1.30 Kg a.i. ha⁻¹ annum⁻¹ (potato), 2.10 Kg a.i. ha⁻¹ annum⁻¹ (onion), 2.8 Kg a.i. ha⁻¹ annum⁻¹ (brassica), and 0.02 Kg a.i. ha⁻¹ annum⁻¹ (tomato) by Holland and Rahman [11]. Similar pesticide usage has been investigated in the Ahmednagar district of Maharashtra's brinjal [12] tomato Sali, [13] and chilli (Raut, 2016). Similarly, in the Ahmednagar, Pune, and Nashik regions of western Maharashtra, India, brinjal and tomato (Patil, 2017 with 2.99 and 3.07 Kg a.i. ha⁻¹, respectively) and cabbage (1.65 Kg a.i. ha⁻¹).

According to research done in Dindigul, the pesticide usage pattern in chilli (5.13 Kg a.i. ha⁻¹), brinjal (4.64 Kg a.i. ha⁻¹) and okra (3.71 Kg of a.i. ha⁻¹). A study of pesticide intensity found that chillies were the most heavily used, followed by brinjal and okra. Even though there were higher pesticide applications in cauliflower, the pesticide intensity was modest [14]. Guru et al. [15] performed a study of polyhouse and open field

capsicum producers in Western Maharashtra and found that the share of conventional insecticides (65-72%) was higher than the percentage of new insecticides (22-25%) and biopesticides (3-13%).

Similarly, Sawant et al. [16] found that conventional insecticides outnumbered innovative insecticides and biopesticides in a cabbage-growing area in western Maharashtra. Although chemical management is the primary pest control approach used by farmers in the research region, a small percentage of producers use biopesticides as well.

According to Shinde et al, [9] majority of spinach growers relied on novel insecticides (52.95%) followed by conventional (37.84%) and biopesticides (9.21%)

3.1 Pest Control is Universally Acknowledged among Fenugreek Farmers

We carried out an investigation of fenugreek growers to know more about their basic knowledge of insect pests, their natural enemies, and how to control them in fenugreek production. The collected information was converted to a percentage of responders. Table 3 & Fig. 3 summarizes the data.

I. Knowledge of the pest problem

According to the thorough data obtained from the research of the Ahmednagar, Pune, and Nashik districts, the fenugreek producers in the Nashik area were more aware of the pest problems than those in the Ahmednagar and Pune districts. As comparison to Ahmednagar (64%) and Pune (61.50%), fenugreek producers in Nashik district (64.50%) were more aware of the issues caused by insect infestations. It was shown that nearly 63.33 percent of fenugreek growers were conscious of the seriousness of pest problems and could identify some insect pest from the other. The most common insect pests were sucking pests, as per research. The greatest obstacle to cultivating fenugreek was the leaf miner, which was less burdensome than aphids during the crop's growth phases.

“Many growers were also aware of the minor problems like thrips, defoliators, etc. Many growers were also aware of the minor pest problems like thrips, defoliators, etc” [9]. Malgie et al. [17] reported that “the farmer’s knowledge about pest problems is the basic need to start over the management practices and borers and

whiteflies were the most troublesome pests according to the majority of the respondents in all three stages of several vegetable crops, including tomato, cabbage, string beans and lettuce”.

According to Munyuli et al. [18], 71.5% of farmers had no understanding need to distinguish the various types of insect pests. According to research that has been done on cabbage by Badii et al. [19], farmers identified *Plutella xylostella* as the primary pest throughout the growing season, with population abundance being 43% and 65% during the vegetative and heading stages of the crop, respectively. 52.33 percent of survey respondents were aware of pest issues, based on a study by Brar et al. [20]. According to Guru et al. [21], 21.33 percent of growers of capsicum in open fields and 73.23 percent of growers of the vegetable in polyhouses were aware of the insect issues.

II. Knowledge about natural enemies

The majority of fenugreek growers in the study area (60.66%) were aware of the natural enemies that appeared in their particular crops. In furthermore, the survey revealed that 64, 64, and 54 percent of producers in the districts of Pune, Nashik, and Ahmednagar were aware of the natural enemies of fenugreek's insect pests.

According to Baral et al. [22], who indicated that nearly 49% of farmers were aware of beneficial insects in eggplant fields, the recent results accord with their findings. According Mahantesh and Alka Singh [23], 41.5% of farmers who grow vegetables were aware of the pest's natural enemies. Ramakrishnan et al. found that just 16% of farmers were aware of the natural enemies in curry leaf [24].

Similar to this, Western Maharashtra tomato, brinjal, cabbage, and capsicum producers were aware of the natural enemies of the particular insect pests found in their fields [25,26,15,9]. Yadav et al. [27] found that, on average, 60.0% of farmers were aware of natural enemies.

III. Knowledge about biopesticides

It was revealed that one of the commercial biopesticides that growers oftenly used to control insect pests was neem-based formulation products. Notwithstanding, to control insect pests in green crops, the majority of growers depended on both conventional and novel insecticides. The

data confirms that, irrespectively of district, 66.66% of fenugreek growers were knowledgeable of biopesticides. Also, it was found that the biopesticides and their merits were known to 74, 70, and 56% of the fenugreek growers in the Pune, Nashik, and Ahmednagar districts, accordingly.

The latest results are in line with research performed by Kamarulzaman et al. [28] that showed 54.3% of vegetable producers applied biopesticides on their fields. Additionally, it was determined that despite the fact that biopesticides might control the pest, it was difficult to encourage their use among vegetable farmers. According to Odhiambo et al. [29] farmers in cabbage-growing regions employed only 4.23 percent biopesticides.

According to Sawant et al. [16], Shinde et al., [9], Guru et al. [15], the majority (Nearly 65%) of the growers of cabbage, spinach and capsicum in the Ahmednagar, Pune, and Nashik districts were aware of the use of biopesticides. Just 40% of respondents were found to have awareness about biopesticides, according to Yadav et al. [27], suggesting their poor impression of biopesticides and the dangers of pesticides.

IV. Knowledge about recommended insecticides in fenugreek

The findings also showed that the fenugreek growers in the survey area were unaware of any prescribed insecticides for a specific fenugreek insect problem. The Central Insecticides Board and Registration Committee (CIB & RC) also does not prescribe any insecticide for fenugreek's insect nuisance.

V. Knowledge about the harmful effect of insecticides residues

The majority of fenugreek growers in the Ahmednagar, Pune, and Nashik districts were aware of the negative consequences that pesticide residues could have on people's health. The majority of growers were aware of the negative consequences of pesticide residues.

The earlier researchers' surveys provide support for the current findings. It was observed that a larger number of respondents were aware of the risks associated with the use of insecticides at various application stages. Nearly all farmers (99% as per Damalas et al., [30]; 99.4% as per Karunamoorthi, [31] were aware that pesticides can have serious negative effects on users' health. Aproximately, 62.33% [20], 65.33% [32],

74.5% [8], 79% [33], and in some situations, 83% [33].

In the mustard crop, (77.5%) of farmers were aware of pesticidal risks [5]. According to Mahantesh and Singh, (41%) of farmers were aware of pesticide hazards [23]. Similarly, Abbassy [34] revealed that (58.1%) of the people surveyed were conscious of the adverse health effects of pesticides, however Sneha et al. [35] reported that (16.66%) of farmers were aware that pesticide residues were detected in vegetables.

According to Sawant et al. [16], 25% of cabbage gardeners, Shinde et al., [9], 26.66% and Guru et al. [15], (76.67%) polyhouse growers, & (40%) field condition capsicum growers in Ahmednagar, Pune, and Nashik in Western Maharashtra are aware of the surrounding environment and the impact of insecticides [36-39].

4. CONCLUSION

The insecticide usage patterns of selected farmers from Western Maharashtra districts such as Ahmednagar, Pune, and Nashik revealed that fenugreek growers relied primarily on novel insecticides, followed by conventional insecticides, with very few growers applying biopesticides to control fenugreek insect pests. Survey also revealed that the majority of fenugreek growers aware about the insect pest problem in fenugreek, use of biopesticides and natural enemies of sucking pests of fenugreek although a small number of fenugreek growers know about harmful effect of insecticides on human health and no one knows about recommended insecticides in fenugreek but farmers still used some systemic insecticides for control of insect pests of fenugreek.

CONFERENCE DISCLAIMER

Some part of this manuscript was previously presented in the conference: 3rd International Conference IAAHAS-2023 "Innovative Approaches in Agriculture, Horticulture & Allied Sciences" on March 29-31, 2023 in SGT University, Gurugram, India. Web Link of the proceeding: <https://wikifarmer.com/event/iaahas-2023-innovative-approaches-in-agriculture-horticulture-allied-sciences/>.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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