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Insecticide usage pattern in cabbage crop of Karnataka and Andhra Pradesh

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Abstract
A roving survey was conducted during December 2018 in major cabbage growing regions of Andhra pradesh and Karnataka. Apart from incidence level of different insect pests, information on the usage of insecticides, pattern and their frequency of application were also collected. An array of insect pests such as Mustard aphid, (*Lipaphis erysimi* Kaltenbach), cabbage leaf webber, (*Crocidolomia binotalis),* cabbage semilooper, (*Trichoplusia ni* Hubner), and cutworms, (*Agrotis ipsylon* Hubner), and diamondback moth, (*Plutella xylostella* Linnaeus) posing obstacle for cabbage production in the region. Diamond back (*P. xylostella* L.) moth was the major one among all of them. Majority farmers used insecticides belongs to different groups for protection of the crop against insects in this region and were being used in all possible combinations, dosages and frequencies. As many as 29different insecticides were used by the farmers to manage the diamondback moth and about 75.32% of farmers mixed two or more insecticides together without knowing their compatibility or active ingredients. It was noticed that 83% of the farmers did calendar based spraying without bothering about presence or absence of insects whereas, the rest (16.88%) sprayed as and when insect appeared. Only 18.18 per cent farmers adopted a waiting period of fifteen days before harvest and the 76% of the farmers sprayed higher than the recommended dosage. The study concluded that cabbage farmers still misusing the insecticides and might be the sole reason for development of resistance in cabbage the insect pests, especially diamond back moth.

Keywords: Cabbage, diamond back moth, insecticide usage pattern

Introduction

Cabbage is one among thegroup of winter vegetables, grown in tropical and temperate regions of the world. Cabbage (*Brassica oleracea* L. var. *capitata*) is being grown majorly in Uttar Pradesh, Orissa, Bihar, West Bengal, Assam, Karnataka, Maharashtra, Madhya Pradesh and Tamil Nadu, with an area of 3088 hectares with production of 8.75 million tones in India. The vegetable is grown across the seasons throughout the year over an area of 3,200 hectare with an annual production of 1.98 lakh metric tonnes having an average productivity of 24.6 t/ha in Karnataka [2].

Diamondback moth (DBM), *Plutella xylostella* (Linnaeus), is the most serious cosmopolitan pest causing economic loss in cruciferous vegetables including cabbage in Karnataka. The crop loss due to infestation by DBM was ranged from 52 to 100 per cent [5]. The pest management in this vegetable crop is largely insecticide based and variety of insecticides belongs to different groups are used to reduce the losses caused by this pests. These synthetic insecticides have been creating environmental consequences which include toxic residue in food, soil, water, adverse effects to non-target insects and other beneficial organisms as well as the development of resistant strain of the insect pests [8].

Insecticide usage pattern in Karnataka against (*Helicoverpa armigera* Hubner) was followed the typical cocktail system with all major groups of insecticides in major crops and this indiscriminate use of Insecticides further lead to the development of resistance in the *H. armigera* (Sagar *et al.* [7]; Honnakerappa and Udikeri [4].

The improper use of synthetic insecticides is an issue of much concern. It has been estimated by the World Health Organization (WHO) that about 20,000 people die each year from insecticide poisoning and at least 3 million people suffer acute health effects. Research has shown that diets with greater proportions of fruits and vegetables can prevent or delay a number of debilitating and life-threatening diseases. At the same time, public acceptance and adoption of these findings is being discouraged by the possible health risk associated with minute amounts of insecticide residues, sometimes found in or on these foods [3].

The present study was undertaken to document the incidence of the diamondback moth and usage of various insecticides in cabbage by farming community of Karnataka and Andra Pradesh.

Materials and Methods

A field survey was conducted during the December 2018, to record the insecticide usage pattern to control the diamond back moth in cabbage ecosystem of major vegetable growing regions of Karnataka viz., Bengaluru, Belgaum and Chittoor district in Andra Pradesh of south India respectively. A total of Seventy seven (77) farmers were randomly selected for interview and questionnaire administration in the three villages of the each district (Table 1). Questionnaire includes: active ingredients of the insecticides, trade name/common name of the insecticide,type of sprayer used, dosage of the insecticide used, frequency of spraying in a growing season, time spraying took place, efficiency of insecticides in terms of eliminating the insects pests, spraying intervals, safety precautions adopted, and period between last spraying and harvesting and the feedback from the farmer about the efficacy of the insecticides.

Data from the survey was statistically analysed using the statistical package (SPSS version 20.0). The results were presented in pie charts and tables with the values in percentages.

Results and Discussion

Results of the field survey are shown in pie charts covering the insecticides used, frequency, interval and reasons for choosing in the cabbage, is given below.

Insecticides Used by Farmers: A total of 29 different types of insecticides were used by farmers to control insect pests in cabbage production. The insecticides such as chlorantraniliprole > emamectin benzoate > flubendiamide > indoxacarb > chlorfenapyr > spinosad > novaluron > tolfenpyrad > cartap hydrochloride and dichlorovos were the most commonly used in both the states (Table 2). However, the cartap hydrochloride was extensively used in the Andra Pradesh. All kinds of insecticides, whether registered or not, were being used by farmers to control insect pests. These practices also contributed to indiscriminate use of insecticides leading to the higher residue levels in cabbage heads. Results are in line with the work of Vastrad [8].

Mixing of different insecticides together for Spraying: As many 75.32% of interviewed farmers tank mixing of different insecticides maximum of 4 together and as much as 24.67% farmers used sole insecticides for the control of pests (Figure 1), mainly diamond back moth. The results further revealed that farmers did the mixing without considering the effectiveness of each chemical. Farmers opined that mixing of two or more insecticides, enhance the toxicity and will result in to increased control. This denotes a clear misuse of insecticides which would affect the health of growers and the consumers as well as the quality of the cabbage heads. The low educational background and lack of knowledge about insecticide has led them to go for indiscriminate usage. Results are in line with the work of Vastrad [8], and Amoako *et al.* [1].

Reason(s) for choosing insecticides by farmers: It mainly depends on their perception, opinion of nearby farmer, advice of private insecticide dealer, availability in the market and price of the insecticide. Twenty-nine percent (29%) of the farmers interviewed chose insecticides based on their availability in market in their area. The 12.9% of the farmers chose insecticides based on the low price and the remaining 44% chose specific insecticides based on their efficient control of insects pests. Choice of specific insecticides by farmers mostly depended on the availability in the market and the suggestions from the dealers. Many farmers purchase the insecticide based the price, trade name, farmer's experience and advices from the neighbor. The results in agreement with Sachin and Suchitakumari [7] they revealed that majority of the farmers choose insecticides on the advice of private dealers and from the neighbor farmers.

Spray schedule for the insecticide application: Eighty three per cent (83.11%) of the farmers interviewed were adopted calendar based or weekly application without bothering about the presence or absence of insect pests (Figure 3). However, 16.89% of the farmers spray insecticides against insect pests upon noticing insect on the crop without any consideration for threshold level. The cabbage grower has a predetermined assumption that, if they grow cabbage, repeated application of insecticide is inevitable.

Frequency of spraying insecticides: About 19.48% of the farmers sprayed insecticides between 0 to 10 times in a growing season. A majority (72.72%) farmers, sprayed insecticides between 10 to 20 times within a single growing season to control insect pests infestation. About 7.78% sprayed more than 20 times within a growing season of cabbage cultivation (Figure 4). The study also revealed that the frequency of spraying depended on the type and the dosage of insecticides used. The farmers used recommended insecticides such as coragen, proclaim, fame, DDVP, tracer and karate more frequently (3-4 days or weekly interval). Also, 58% of the farmers indicated that the insecticides used in controlling insect pests were highly effective (*i.e*. 80-90% control of insect pests). Thirty one per cent (31%) of the farmers, indicated that insecticides used in controlling insect pests were moderately effective (*i.e*. 60-70% control of insect pests). The remaining 11% of the farmers opined, insecticides used in their cabbage farms were less effective (40-50% control of insect pests), in controlling insect pests and however, newer insecticides *viz*., fame, coragen, proclaim, avaunt etc. were highly effective. the results are in line with the study of Honnakeerappa and Udikeri [4] they revealed that the farmers sprayed an average of 1.0 to 3.0 rounds to combat *H. armigera* in tomato and mostly newer insecticides were used by them.

Spraying intervals: Thirty per cent (30%) of the farmers sprayed their crops at weekly interval. Twenty one percent (21%) sprayed at 10 days interval. Twenty five percent (25%) of the farmers sprayed at 10 to 15 days interval. Nineteen per cent (19%) of the farmers sprayed at fortnightly interval. However, 7% sprayed at 15 to 20 days interval (Figure 5). It was also observed that 78 per cent of the farmers interviewed were continued to spray the insecticides up to head harvest. This led to higher residue levels on the fresh cabbage. The remaining 28%, however, stopped spraying of insecticides during the time of harvesting and on an average 5 days were allowed as waiting period after spaying. The farmers could not wait for the safe harvest period because they do not want

insect damage on crop, which reduces market price. Results are in line with the earlier work of Vastrad [8]; Sachin and Suchitra Kumari [6].

Dosage of insecticides applied and safety precautions adopted by farmers

Figure 6. indicates that only 20 per cent of the farmers used only recommended rates of various insecticides for the control of insect pests. Majority (76.62%) of them used dosages above the recommended rate. The remaining 4 per cent however, used the dosages below the recommended rate of application. This is due to the lack of technical knowledge and socio-economic conditions. Results are in line with the work of Amoako *et al.* [1]. Majority of the farmers are not at all using the safety measures, such as the use of protective clothing and nose respirators during spraying of insecticides. Further questioning revealed that they actually meant using simple nose masks (sometimes wet rags or hand kerchiefs) during spraying. Most of them were also not aware of the effect of wind direction and spray drift. There were minor differences in spraying practices from place to place and the paucity of published work limits the discussion on present findings.

Table 1: Details of the villages covered in the survey

1	Karnataka: Belgaum	Bylahongal	Bachanakeri
		Belgaum	Hirebagewadi
		Gokak	Mutnal
2	Karnataka : Bengaluru rural	Bengaluru north	Singanayakanahalli
		Bengaluru north	Shivakote
		Hoskote	Makanahalli
3	Andra Pradesh : Chitoor	Chittoor	Putalapattu
		Punganur	Somala
		Pulicherla	Kallur

Table 2: Insecticides used in the cabbage ecosystem

Sl no.	Active ingradient	Trade name
1	Chlorantraniliprole 18.5% SC	Cover,Coragen
2	Flubendiamide 480 SC	Fame
3	Emamectin benzoate 5%SG	EM1, Proclaim
4	Tolfenpyrad 15 EC	Keefun
5	Chlorfenapyr 240	Interprid, Hunter
6	Chloropyriphos 20 EC	Dhanban
7	Diclorovos 76 EC	Nuvan
8	Novaluron	Rimon
9	Indoxacarb 14.5 SC	Avaunt
10	Spinosad45 SC	Spinter
11	Chlorantraniliprole + Lambda cyhalothrin	Ampligo
12	Chloropyriphos + Cypermethrin	Cyclone
13	Monocrotophos 36 SL	Monocel
14	Cartap hydrochloride	Dartiz
15	Deltamethrin	Decis
16	Imidachloprid 17.5 SL, Imidachloprid 30.5 SC	Confider, Commando Cohigen strong
17	Dimethoate	Rogar
18	Quinolphos	Krush 25 EC
19	Triazophos 40 EC	Ghataka
20	Emamectin benzoate 5 SG	Amon
21	Chlorantraniliprole 18.5 SC	Coragen
22	Cartap Hydrochloride	Beacon SP
23	Spinosad 480 SC	Spinter
24	Novaluron +Emamectin benzoate	Barazide
25	Chloropyriphos + cypermethrin	Cyclone
26	Flubendiamide	Fame
27	Diclorovos 76 EC(Mix)	Nuvan
28	Profenophos 50 EC	Profigen
29	Azardiractin	Azatec

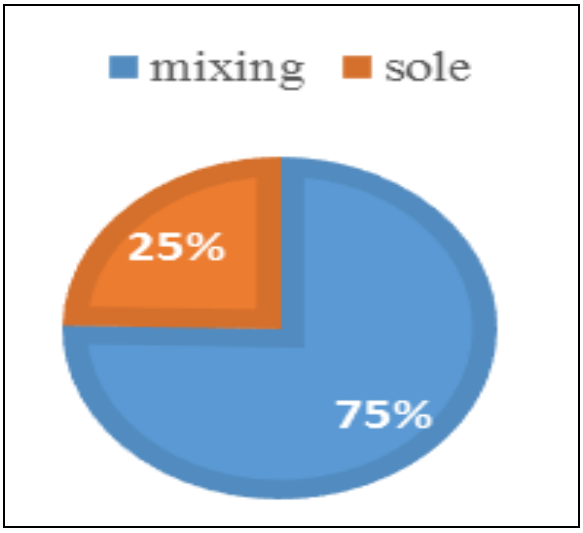

Fig 1: Tank mixing of different in secticides

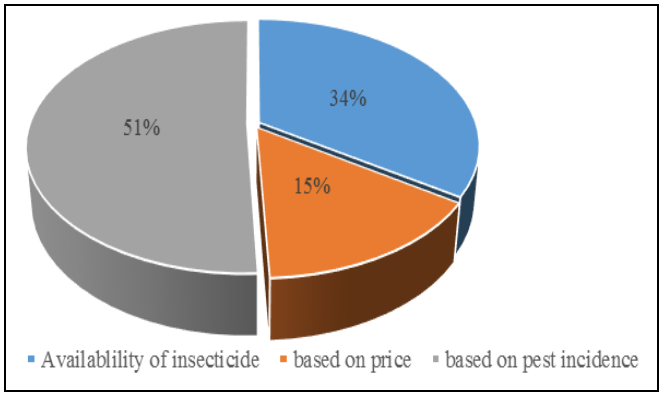

Fig 2: reasons for choice of pesticide

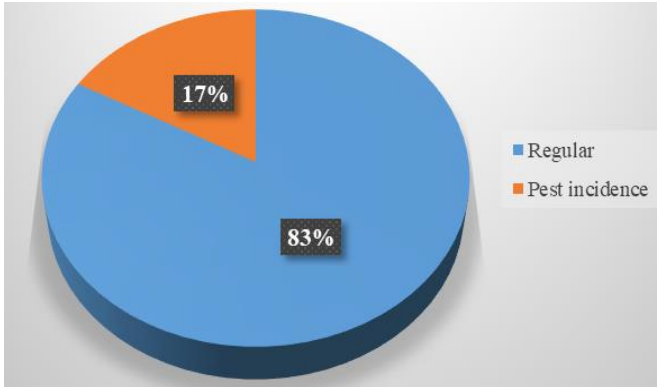

Fig 3: Schedule of application

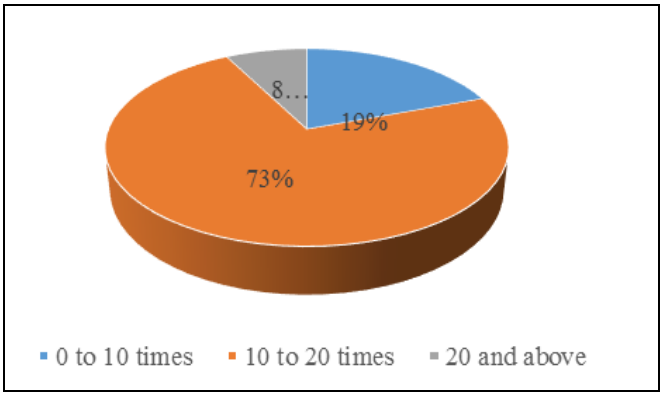

Fig 4: frequency of spaying till the harvest

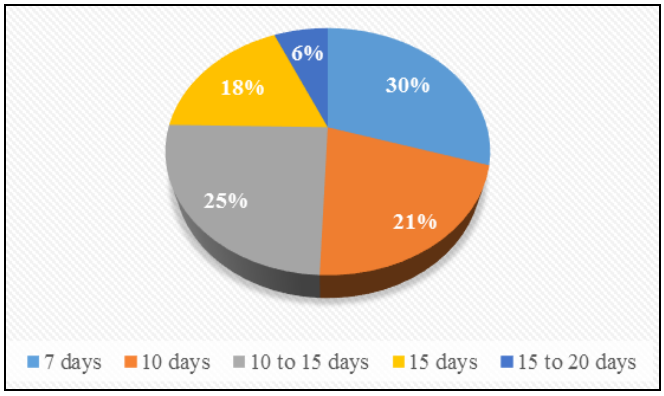

Fig 5: Spraying Interval (Days)

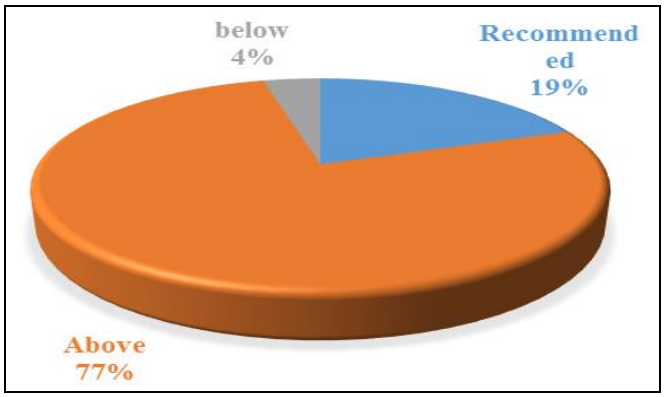

Fig 6: Dosages of insecticide applied

Conclusion

The result of field survey revealed that as many as 29 different insecticides were used to manage diamond back moth (*P. xylostella* L.) in cabbage. The major classes of insecticide used were in the order as follows organophosphates > anthranilic diamides > avermectins > pyrazoles > pyrrole > oxadiazines > neris toxin > pyrethroids > neonicotinoids. Among the various insecticides used chlorantraniliprole > emamectin benzoate > flubendiamide > indoxacarb > chlorfenapyr > spinosad > novaluron > cartap hydrochloride taken upper hand. These insecticides were mixed with many other insecticides without knowing their compatibility, mode of action and other ill effects. The farmers opined that the pest occurrence was rampant in the growing seasons and could not be managed properly even after imposition of several insecticidal sprays. The spraying of chemicals several times without knowledge about the residue period and reclamation measures led to the accumulation of insecticides on cabbage head. Ultimately the consumers will be exposed to high insecticide residue levels upon consumption of such heads and continues feeding may creates a lot of health hazards. The components of integrated pest management (IPM) are sufficient to combat the insect pests but, farmers are not adopting them. Some of the farmers having the knowledge of benign pest management practices, but they are not in a ready state to adopt such measures.

To mitigate the identified problems, stakeholders such as Ministry of Agriculture, EPA, state agricultural universities and associations of agrochemical dealers must form a common platform to combat the problem of misuse of insecticides and also to impart proper knowledge of pest management to reduce the residue problem on one hand and also to get a good economic return due to effective pest management on the other. These measures would help the

farming community to retain the interest of growing cabbage crop with minimum residue level thus reducing health risks to both growers and consumers.

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