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S Karthikeyan
Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

K Bhuvaneswari
Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

JS Kennedy
Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

A Suganthi
Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

KR Ashok
Department Agricultural Economics, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

R Shanmugasundaram
Department of Soil Science and Agricultural Chemistry, Tamil Nadu Agricultural University, Madurai, Tamil Nadu, India

Corresponding Author:
S Karthikeyan
Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

Constraints faced by cabbage farmers of the Nilgiris district in the adoption of IPM technology

S Karthikeyan, K Bhuvaneswari, JS Kennedy, A Suganthi, KR Ashok and R Shanmugasundaram

Abstract
Integrated Pest Management **(**IPM) is the application of decision making process to select and combine the compatible and efficient management strategies. Practicing IPM is one of the novel approaches in sustainable agriculture. To overcome the hurdles in the implementation of IPM strategies, it is imperative to find the lacunas in the adoption system. The present study was conducted on the constraints faced by the cabbage farmers in the adoption of IPM technology in the Nilgiris district during 2018. A total of 34 farmers were selected for the study and the data were collected through pre-structured questionnaire. Majority of the farmers were facing the highest level of constraints (56%) in adopting IPM technology. Among the constraints, lack of knowledge in ETL estimation (94%) and lack of awareness about natural enemies conservation (94%) were perceived as major constraints by the respondents, followed by lack of technical knowledge about IPM (91%), non-availability of pheromone traps in local market (85%), lack of knowledge about bund crops (82%) and labour scarcity for weeding and manual collection of *Spodoptera* sp. larva (73%). Lack of knowledge in botanical application is found to be the least constraint (2%).

Keywords: Cabbage, IPM, response, constraint levels

Introduction
Cabbage (*Brassica olearaceae* var. *capitata*) is the most important cole crop grown all over the world [10, 18, 19]. India stands second in the production of cabbage which accounts for12 per cent of the global production [10, 13]. Cabbage has rich source of nutrients comprising all nine essential amino acids (histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine), vitamins (Vitamin B_1, B_2, B_3, B_5, B_9, C and K), minerals (calcium, iron, magnesium, sodium and potassium) and fibre (soluble and insoluble). It is also reported to have antioxidants and anti-carcinogenic properties [7, 12, 13]. Cabbage is cultivated throughout India because of its adaptability to wide range of climatic conditions and soil. The total area under cultivation of cabbage in India is 372 thousand hectares with an annual production to the tune of 8534 thousand tonnes. Despite the larger cultivation area for cabbage, the productivity is very low. In addition to many reasons, infestations by insect pests cause severe loss in production and productivity of cabbage in India [8]. Tobacco caterpillar (*Spodoptera litura*), american bollworm (*Helicoverpa armigera*), diamondback moth (*Plutella xylostella*), Cabbage green semilooper (*Trichoplusia ni*), leaf webber (*Crocidolomia binotalis*), cabbage borer (*Hellula undalis*), cabbage butterflies (*Pieris brassicae* and *P. rapae*), flea beetle (*Phyllotreta brassicae*) and aphids (*Brevicoryne brassicae, Myzus persicae* and *Lipaphis erysimi*) are the common insect pests attacking cabbage in India [2, 16]. Among these, diamondback moth is the most severe pest causing 31 to 100% yield loss [13, 18].
After the discovery of synthetic insecticides, farmers heavily relied upon chemical pesticides as an immediate remedy for the past five decades [3, 14, 15]. A report by Weinberger and Srinivasan (2009) suggests that, cabbage farmers in India rely exclusively on chemical pesticides for the pest management. The synthetic organic insecticides widely used in agriculture are generally broad spectrum biocides and cause injury to all living organisms and to the quality of environment as well [6, 14, 16]. In addition, extensive application, improper handling, inappropriate timing and wrong combination of chemicals resulted in development of pesticide resistance, pest resurgence, increased cost of cultivation and pesticide-induced outbreaks of pests [1, 18]. Therefore, adoption of IPM is cost effective and sustainable approach for maximizing the yield.

IPM does not completely exclude application of chemical pesticides but emphasizes the growth of healthy crop with least possible disruption of agro-ecosystem and encourages natural pest control mechanisms [1]. Most of the pesticides applied in the cabbage fields were listed as extremely or highly hazardous by World Health Organization [18]. IPM developed by the scientists, have not been integrated into the farming practices of the farmers in order to convert them into production accomplishments. The empirical evidences about the impact of IPM in terms of knowledge and adoption in vegetable crops are meager. In this context, the present study was conducted to identify the major constraints faced by the cabbage farmers in the adoption of IPM technology.

Materials and Methods

Study area, sampling and data collection

The study was conducted in the Nilgiris district situated 11^0 25'N, $76^0$41'E at a Mean Sea Level of 900 to 2636 metres above MSL, representing Southern Plateau and Hills agro climatic zone. The Nilgiris district of Tamil Nadu possesses an annual average temperature of 15 ^{0}C with an average summer temperature 20 ^{0}C and winter temperature of 10 ^{0}C. Since, the prevailing climatic conditions are highly favorable for the production of cole crops in the Nilgiris and one among of the major producer of cabbage in the state and chosen for the study. Totally, 36 respondents were selected by following simple random sampling. A detailed questionnaire relevant to IPM adoption in cabbage farms was prepared in consultation with Agricultural Economics department, TNAU, Coimbatore. At the time of interview each question was asked in an understandable manner in local language.

Observations

All the responses in the interview schedule were given numerical coded values and were considered as adoption scores. Data on the awareness about IPM, ETL, natural enemies conservation, synchronized sowing, trap crops, crop rotation, residual effect of chemical pesticides and the constraints faced by the farmers about the skill in application of biopesticides, install yellow sticky traps, NSKE preparation and non availability of required fungicides or insecticides at the local market, power supply to the field, parasitoids and pheromone traps etc., were collected from the selected number of farmers.

Criteria	Adoption Score
Awareness and adoption	2
Awareness and no adoption	1
No awareness and no adoption	0

Statistics

All the data collected and information generated were tabulated and statistically analyzed to calculate the constraint scores. The constraint level was obtained by categorizing each farmer under each constraint and the mean and SD values were calculated using adoption score. Mean per cent score was calculated for each constraint and ranked.

Results and Discussion

The respondents were divided into three constraint levels *viz.*, high (>17.98), medium (4.73 – 17.97) and low (<4.72) based on the adoption score (Table 1). It is clearly evident that, the majority of the cabbage farmers experienced higher constraint levels (55.88%), whereas 23.53% were in medium level and 20.59% in low constraint.

Table 1: Distribution of respondents according to their constraint level in adoption of IPM in cabbage cultivation n=34

Constraint Level	Frequency	Per cent
High constraints (>17.98)	19	55.88
Medium constraints (4.73 – 17.97)	8	23.53
Low constraints (<4.72)	7	20.59
Total	34	100

Altogether 20 constraints were experienced by the cabbage farmers in the adoption of IPM technology and they are listed in Table 2. Out of 34 farmers, 32 farmers lack the knowledge in ETL estimation and about natural enemies conservation (94.12%) by which it can be inferred that the above two constraints were the most serious, followed by the lack of technical knowledge about IPM (91.18%). The results of the present study are in concordance with the findings of Routu (2016) who reported that, the chief constraint was lack of knowledge about ETL [11].

Furthermore, access to the pheromone traps is also another major constraint due to its non-availability in local market (85.29%) followed by lack of knowledge about bund crops (82.35%). The findings of Gopal *et al.* (2014) revealed that lack of awareness and skill, low practicability, non-availability of inputs as the major constraints in adoption of pheromone traps which was in agreement with our results. It is important to keep the crops free from weeds and pests. Regarding pest management, manual collection of *Spodoptera* is highly recommended. In view of this, the non-availability of labours for pest and weed management was also found to be one of the important constraint (73.53%). The results of our study are in well accordance with the findings of Govind and Perumal (2010) who reported labour scarcity as fourth important constraint [4, 5].

Table 2: Constraints Perceived by the Cabbage Growers in Adoption of IPM n = 34

S. No.	General constraints	Mean Per ncent Score	Rank
1	Non-availability of fungicides/ pesticides for seed treatment	41.18	13
2	Lack of knowledge about planting time of trap crop	64.71	9
3	Non-availability of power supply to the field (light trap)	44.12	12
4	Lack of knowledge about *Beauvaria bassiana*	61.76	10
5	Non-availability of parasitoids (*Cotesia vestalis*)	23.53	14
6	Lack of skill in NSKE preparation	11.76	17
7	Lack of technical skill to install yellow sticky trap	17.65	15
8	Lack of knowledge about bund crops	82.35	5
9	Lack of labour availability for weeding & manual collection of *Spodoptera*	73.53	6
10	Lack of knowledge in preparation of botanicals	2.94	20
11	Lack of awareness about natural enemies conservation	94.12	1
12	Non-availability of pheromone traps in local market	85.29	4
13	Lack of knowledge in ETL estimation	94.12	1

14	Lack of knowledge about spraying time	8.82	18
15	Lack of awareness of avoiding spraying in heavy winds	5.88	19
16	Lack of technical knowledge about IPM	91.18	3
17	Lack of awareness about the application of neem oil	14.71	16
18	Lack of knowledge about crop rotation	70.59	7
19	Lack of awareness about hazardous and residual effect of chemical pesticides	67.65	8
20	Lack of skill about biopesticide application	55.88	11

*Multiple response were obtained

The lack of knowledge about crop rotation (70.59%) stands as seventh major constraint. The sole dependence of insecticides among the cabbage farmers may serve as a reason for the lack of awareness about hazardous and residual effect of chemical pesticides (67.65%). Synchronization with the main crop and the land preparation for trap crops act as a barrier (64.71%) which may be due to its practicability followed by the lack of knowledge about biocontrol agents (*Beauvaria bassiana*) (61.76%). The above mentioned were the most important ten constraints.

More than 50% of the farmers consider difficulty in the application of biopesticides (55.88%) followed by the lack of power supply as a barrier to install light traps (44.12%). The constraints such as the non-availability of parasitoids such as *Cotesia vestalis* which is widely recommended against the major pest *Putella xylostella* (23.53), lacuna in the skill to set up yellow sticky traps (17.65%), lack of awareness in neem oil application (14.71%) and NSKE preparation (11.76%) were of minor importance.

Analysis of the data indicated that only less than five farmers lack the knowledge about the spraying time (8.82%), precautions during spraying (5.88%) and botanical preparation (2.94%) which can be inferred that the farmers are well versed with the botanicals and spraying methods. A similar finding was reported by Nidhi and Kalsariya [9].

Conclusion

From the constraint analysis, it can be concluded that the lack of knowledge is the major constraint. The reach of extension personnel to the farmers, lack of trainings, lack access to the media related agriculture and IPM might be reasons for the farmers facing constraints. It is important to create awareness about all the available and suitable technologies, developing skill and assessment of such technology at local areas. Farmers in the Nilgiris district must be trained properly in IPM for successful implementation of ecofriendly pest management. Combination of appropriate measures can be advised to the farmers through extension personnel which may help the farmers to combat the constraints in the adoption of IPM.

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