IPM IN VEGETABLES : NEEDS FOR SUSTAINABLE RURAL DEVELOPMENT

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The Ecological system involves the relationship between humans, animals, plants, micro and macro invertebrates, water, sun etc. In this relationship it is easy to see the effects on human life, air to breathe, food, drinking water-human life depends on the ecological system. If there is no disturbance, then there is a natural balance. In recent past, many new varieties have been introduced to increase the production growth rate of vegetables. These input intensive high yielding varieties/hybrids with good agronomic traits and yield attributes have gradually changed the pest situation. Among the various methods of pest control, chemical method still enjoys first choice because of its quick and certain action. Consequently, vegetables consume about 13-14% of the total pesticide consumption in India, although only 2.6% of cropped area falls under vegetables. As the result many pests have adapted new hosts, developed resistance to pesticide, natural enemies are destroyed, previously innocuous insects have become major pests and high chemical residues have been detected in the produce as a result our soil and water system have been polluted. Consequently, a shift in pest management has been realized in time and space giving the concept of integrated pest management. ***Integrated Pest Management*** is traditional methods which revolves around the natural ecological systems, generally rely primarily on biological defenses against pests instead of chemically altering the environment and is the best alternate option to sustain plant protection in vegetables. It is the integration of all suitable management techniques with natural regulating and limiting elements of the environment. It is a multidisciplinary approach, which includes all pest management tactics co-ordinate in a unified programme, and crop protection is considered as one aspect of agro-ecosystem management and addresses the economic, ecological and social issues. The components for successful Integrated Pest Management consists participatory approach by the community mainly of insect pests monitoring, integration of tactics, decision-making and implementation. Thus, Integrated Pest Management is a traditional method, which revolves around the natural ecological systems. In the past, humans had many methods to limit pest population problems however now there are some agriculturists who have thrown away this method to one which damages themselves and their environment. There are many complex factors that influence sustainable rural development and food security. It is therefore, clear that IPM in vegetables play an important role in preparing farmers and others to make productive contributions in minimizing the use of chemical pesticides in vegetables, especially in those vegetables which are consumed mostly row by the people viz., tomato and cabbage.

METHODOLOGY

Vegetables like, Tomato and Cabbage are harvested at short intervals and chemical method of plant protection has become risky and hazardous. Keeping this in view an IPM module for tomato and cabbage were developed by Indian Institute of Vegetable Research, Varanasi and these modules were implemented in the farmers' field of Varanasi district. Varanasi, which is a major vegetable-

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growing district of Uttar Pradesh harvesting tomato and cabbage as main vegetable crops in rabi season in which farmers are using number of chemical pesticides which is hazards for both human health and environment. Therefore, for the present study, Varanasi district was purposively selected and fifty tomato and cabbage growers were randomly sampled separately from Jayapur and Dharakhu panchayat of Arazilines block. Regular required data were collected from the farmers' field to see the impact of IPM modules on farmers' field and also, the data were collected before the implementation of project from the sample farmers through personal interview with the help of a questionnaire developed for the purpose to see their awareness about IPM. The questionnaire used to measure the awareness of the farmers about the practices, which directly or indirectly are part of IPM. The collected data were later tabulated and analyzed for drawing desired interpretations.

RESULTS AND DISCUSSION

Individual practice wise data of tomato and cabbage growers were also worked out to get the clear idea about the extent of IPM awareness in tomato and cabbage growers.

IPM Awareness Among Tomato and Cabbage Growers–The data regarding awareness of IPM practices among tomato growers are worked out in percentage and ranked and presented in Table 1.

From Table 1, it clearly indicates that all the members of tomato growers sample were aware of field monitoring and use of chemical pesticides. On the other hand only 56% of the farmers have complete knowledge of insects and diseases and the symptoms of their infection/infestation in tomato. It indicates that about 40% tomato growers who superficially monitor the field, keeping in mind other crop husbandry practices mostly the status of plant growth, flowering, fruiting time, interculture and irrigation etc., while less concerned about pests and diseases. It is most interesting to analyze two facts of information on chemical pesticides i.e., their use and knowledge of correct dose of pesticides. In one hand all the farmers having knowledge of pesticides while only 8% were aware of recommended dose for use in tomato. This indicates the misuse and overuse of chemical pesticides in such an important vegetable crops which signals not only hazards on human health but, also increase the cost of cultivation where pesticides are major inputs. Such things also perpetuates in the form of control failures due to insecticides resistance and secondary pest outbreak consequent to heavy mortality of natural enemies. Further considerable section of farmers were aware of various IPM practices such as hand removal of pests (56%), burning of stubbles (44%) and seed treatment (28%) where as only 4% of them were aware of IPM strategies. It is imperative that the tomato growers although practice some of the IPM practices separately, their awareness about IPM in total is negligible. Most of them adopt the practices separately but not in the form of a total module.

Table 1. Ranking of IPM practices in tomato and cabbage on the basis of farmers' awareness

S. No.	IPM Practices	Frequency (N=100)	%	Rank
1.	Monitoring of field	100	100	I
2.	Identify insect pest	56	56	II
3.	Use of chemical pesticide	100	100	I
4.	Recommended dose of pesticide	8	8	V
5.	Hand removal of pest	56	56	II
6.	Fallowing of field	28	28	IV
7.	Allow weeds during fallowing	28	28	IV
8.	Chiseling & soil solarization	-	-	-
9.	Burn crop stubble	44	44	III
10.	Aware of friendly insects	-	-	-
11.	Aware of IPM strategies	4	4	VI
12.	Biological control of insect pest	-	-	-
13.	Seed treatment	28	28	IV

Surprisingly, despite the farmers good awareness about insect-pests (56%) but none of them are aware of friendly insect in the field, which is reducing either as a result of indiscriminant use of chemical pesticides or total lack of knowledge about natural enemies. None of the farmers were aware of two important practices i.e., soil solarization and biological control of insect pest. Hence, it indicates that the farmers are not at all aware of biological control and other important IPM practices. Therefore, farmers need to be trained on adoption of a complete IPM module of tomato.

Impact of IPM Modules–The IPM module implemented in the farmers' field emphasized on the various integrated management practices for controlling diseases and insects-pests in tomato and cabbage from soil solarization to seed bed preparation, seed treatment and finally transplanting in main fields and till harvesting of crops. Regular monitoring and collected data (Table-2) clearly reveals that even during the peak cropping season August and September infestation due to disease and insects-pests were more in Non IPM fields than in IPM fields.

Table 2. Disease and pest incidence in tomato and cabbage

	August 2002		September 2002	
	IPM	Non-IPM (Farmers practice)	IPM	Non-IPM (Farmers practice)
Nursery				
Damping off	10-12%	45-60%	2-5%	35-40%
Bacterial blight	5-8%	25-30%	-	-
Black rot	-	-	<1%	15-20%
Spodoptera litura	-	-	Nil	4-10%
Main field				
Bacterial leaf spot	-	-	2-6%	15-22%
Leaf curl (TLCV)	-	-	<2%	8-10%
Spotted wilt (TSW)	-	-	2-4%	5-10%

Further, overall comparison between the two plots clearly indicates the differences between IPM and Non IPM plots.

IPM plots	Non-IPM plots
In nursery of tomato crop problem of damping off was negligibly observed.	In nursery of tomato crop problem of damping off was severely observed.
In tomato nursery and main field incidence of bacterial leaf spot was fully managed.	In both tomato nursery and main field severe bacterial leaf spot was observed.
Problem of collar rot is not severely observed in tomato field.	In tomato field there was severe infestation of collar rot.
In main field of tomato less than 5% infestation by leaf curl was observed.	More than 25% of tomato plant is observed by leaf curl.
Incidence of white fly is low in the tomato field.	Incidence of white fly is medium to high in the tomato field.
Low incidence of *Plutella xylostela* and *Spodepotera* is observed in cabbage field.	Severe incidence of *Plutella xylostela* and *Spodepotera* is observed in cabbage field.

Validation of IPM Package at Farmer's Field :

Table 3 indicates that marketable yield of tomato in IPM and non-IPM is not very different but very superior over control. The control was free from any plant protection practices. Cost of cultivation in non-IPM (Rs. 31775.00) is comparatively more that IPM (Rs. 30630.00). IPM practices are effective in tomato and should be recommended for cultivation.

IPM demonstration trial of cabbage at farmer's field (Table 4) clearly indicates that marketable yield is more in IPM plot (385.1 q/ha) than non-IPM (378.6 q/ha). Cost benefit ratio is slightly in favour of IPM (1:2.33) against (1:2.15) in non-IPM. Cabbage crop is not much affected by disease and pest when transplanted in main season; hence, there is not much difference in all these three.

Table 3. Cost benefit ratio of tomato on demonstration trial of IPM at Jayapur

Treatment	Marketable yield (q/ha)	Disease/ infested yield (q/ha)	Gross return* (Rs.)	Total cost of cultivation (Rs.)	Net benefit (Rs.)	C:B ratio
IPM module	315.9	17.5	94770	30630	64140	1:2.09
Non-IPM module (Farmers practices)	327.2	29.4	98160	31775	66385	1:2.08
Control	121.4	59.3	36420	23000	13420	1:0.58

Uniform cost of cultivation for tomato @ Rs. 23000/ha.
*Flat rate of tomato sale @ Rs. 3/kg

Table 4. Cost benefit ratio of cabbage on demonstration trial of IPM at Darekhu

Treatment	Marketable yield (q/ha)	Disease/ infested yield (q/ha)	Gross return* (Rs.)	Total cost of cultivation (Rs.)	Net benefit (Rs.)	C:B ratio
IPM module	385.1	1.7	77020	23100	53900	1:2.33
Non-IPM module (Farmers practices)	378.6	2.3	75720	24043	51677	1:2.15
Control	275.2	13.9	55040	18000	37040	1:2.05

Uniform cost of cultivation for cabbage @ Rs. 18000/ha.
*Flat rate of cabbage sale @ Rs. 2/kg

CONCLUSION

Chemicals destroy not only the pest, but the natural enemy of the pest as well. It is often the case that the life cycle of the natural enemy of the pest is slower than that of the pest itself. Therefore, the injection of chemicals each time reduces nature pest enemy but allows the pest to survive and regenerate quicker as the chemical decreases. In a short time the pest is able to develop a resistance to the new type of chemical, requiring higher concentrations or new chemicals to allow the elimination of the pest. Chemicals are a solution to fix the immediate issue, but not the underlying problem. In these cases, prevention is the best cure. Therefore, it is necessary that the farmers should adopt the integrated pest management strategies by using the appropriate combination of physical, biological and chemical control methods.

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