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On–farm Validation of IPM Module in Tomato in North West Himalayas

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ABSTRACT

This study was conducted in mind- hills of Uttarakhand situated in North West Himalayas (NWH). The IPM module (seed treatment: drenching and root dip @ 1% with Trichoderma harzianum, mancobez sprays @ 0.25 % and HaNPV @ 250 LE/ ha (two spray) installation of pheromone trap, staking & removal of lower leaves, 9" from the soil and one row of marigold after 16 lines of tomato) was validated at farmers fields . Higher emergence of tomato seedling (65- 80%) was recorded in bioagent treated seed at raised beds than untreated seed in flat bed traditionally (40%) followed under farmers practice. Pre-emergence rot in the nursery was controlled to the extent of 41.7–66.7 percent over untreated and flat bed system. On an average 60 percent control of early blight was achieved with IPM practices compared to non-IPM practices. Buckeye rot was immensely reduced (85.7 %) with staking and removal of lower leaves followed by single spray of mancozeb over unstaked and unsprayed tomato plants emphasizing the significant role of staking in the control of this disease. Staking HaNPV and trap crop of marigold recorded 5 per cent borer attack compared to 18 per cent in untreated fields giving 72.2 per cent control of fruit borer. The integrated crop management along with IPM module contributed greatly in attaining economically higher yield than traditional practices. Thus, adoption of IPM module is an economically viable and profitable venture in NWH for healthy tomato production as revealed by B:C ratio obtained by the participatory farmers.

The North West Himalayan region is ideal for cultivation of several high value crops especially vegetables. Production of vegetable crop is influenced by many constraints including lack of profitable crop rotations and high pest incidence. Since ancient time, organic practices for pest management in the hill agriculture are in vogue, though by default. With the advent of new production and protection technologies for enhancing productivity of hill vegetables, there is apprehension of diversion from organic to purely chemical based pest management practices. Moreover, haphazard use of pesticides can lead to environmental pollution as happened in the era of Green Revolution. Recently, detection of insecticide residues in the blood samples of cotton farmers of Punjab and Andhra Pradesh is warning use for their judicious use in pest management. Such reports have emphasized on adopting IPM strategy for fragile ecology of hill region for sustainable management of pests. Such an IPM strategy should stress mainly upon use of ecofriendly pesticides, biological control practices like seed treatment with biopesticides and need based foliar application of pesticides and bio- agents. In the NWH, amongst the vegetables, tomato (Lycopersicon esculentum Mill.) is an important crop which is grown from February to July as off- season and main crop at different elevation and gets inflicted by various diseases and insect pests. Among them, Damping-off (Pythium aphanidermatum), Early blight (Alternaria solani) and Buckeye rot (Phytophthora parasitica) are the major diseases attacking this crop. Early blight alone has been reported to cause 80-86 per cent yield losses in tomato (Pandey and Pandey 2003). Fruit borer (Helicoverpa armigera) and Leaf minor (Liriomyza trifolii) are major insect pests threatening this crop (Arif, 1997) and at time cause more than 50 per cent yield losses (Srinivasan, 1959). The borer reported to develop resistance to many insecticides and is becoming increasingly difficult to control (Krishna and Krishan, 2001). Hence, it is vital to adopt the safer

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management tools for the control of pests in tomato with a prime objective to taking higher productivity and production of this crop using minimum pesticides. Though, individual components of IPM in hills have been reported effective in the experimental studies (Sudhil et al., 2006, Hooda et al., 2006), their validation in the form of IPM package was required to be tested for applicability in the fields for wider adoptability under NWH conditions. Considering this, an IPM module developed (after evaluation of integration of effective components) was validated at farmers fields under Mini Mission-1 for Uttrakhand (HTM).

METHODOLOGY

Thirty two validations on the adoption of IPM strategy in the tomato covering an area of 0.64 ha (32 nail; one nail = 200 m2) were laid in the four selected blocks (Tarikwet – 1090 m amsl, Hawalbagh-1285 m amsl, Dhauladevi – 1800 m amsl and Takula-1300 m amsl) of Almora district. The validations were conducted using variety Him Sona through participatory mode during 2005 and 2006. The farmers were educated about IPM technology through running Farmers Field Schools (FFSs). The IPM module adopted for validations consisted of Trichoderma harzianum seed treatment drenching and root trap, staking and removal of leaves upto 9" from soil; and one row of marigold after 16 lines of tomato. The nursery was sown at a row spacing of 8 cm in raised beds (15 cm above the soil level) in the last week of February with seed treatment of Trichoderma harzianum (Ranichauri Isolate) @ 10 g/kg seed (1x 10 7-9 cfu/gm) and drenching of nursery once with the same bioagent @ 1% to pre- empt the incidence of post emergence rot. One month old seedling root dipped in bioagent solution were transplanted. All the agronomical practices (Vivekananda Pravatiya Krishi Anusandhan Sansthan, Almora, 2002) were followed. The nursery of marigold (African Targets)was sown 20 days prior to the tomato transplanting so that flowering of marigold synchronizes with borer attack at flowering and fruiting stages of the crop. Regular monitoring of borers was done with pheromone traps. Two need based sprays of HaNPV were given at initiation of the flowering whereas second at the time of flowering and fruiting stages. The data on the pest incidence in IPM and non-IPM plots were recorded. Economic analysis was also taken up to calculate B:C ratio of the module to know the profitability of the technology.

RESULTS AND DISCUSSION

Efficiency of IPM practices on seedling emergence and reduction in pest severity

Emergence of tomato seedling ranged between 65-80 per cent with bio–agent treated seeds sown in raised beds as compared to 40 per cent in case of untreated seeds sown in flat bed which is traditionally followed by the farmers of the region. Crop vigor in IPM plots was comparatively better than conventional farmers' plots. Pre – emergence rot was controlled to the extent of 41.7-66.7 per cent over untreated and flat bed system. In the main crop, low to moderate severity of early blight has been observed in all the 32 validations. On an average 60 per cent disease control was achieved with IPM practices as compared to Non- IPM practices. Buckeye rot has been immensely reduced (85.7%) when staking was followed with removal of lower leaves upto 9" level from the soil surface followed by one spray of mancozeb over unstaked , without removal of lower leaves and spray of the fungicide, emphasizing the significant role of staking and removal of leaves in the control of disease. Similar results were obtained by pandey et al. (2005) during testing of an integrated disease management package at farmers' fields. Fruit borer was the only insect pest which posed menace to the crop. Staking with sprays of HaNPV @ 250 LE/ ha and planting of trap crop of marigold recorded only 5 per cent control of fruit borer. This finding is in agreement with those of Suchil et al .(2006).

Effect of IPM practices on the yield of tomato

The block wise yield data recorded from IPM and non- IPM plots showed 185.0 per cent changes in yield (Table 3) between IPM and non- IPM plots on overall basis, though block wise it varied from 142.0 to 222.0 per cent in the same location. Besides, ('t'value -11.5) on overall basis at 0.01 level of probability. Block wise mean yield were also significant at 0.01 probability level.

Economic benefits of IPM practices

The economic analysis of IPM technology was also worked out (Table 1). The analyzed data indicated that vegetable growers received an additional income of Rs. 4094/- per 200 m2 (one nail). Though block wise range of income varied from Rs. 3051 to 5194 (Table 2). Besides , higher B:C ratio (4.49) on overall basis also indicated high economic viability of the IPM technology at the farmers' fields. Therefore , it is a very useful technology for vegetable growers from economic as well as pesticide pollution point view.

Farmers, opinion about IPM module

The participants farmers were well satisfied with performance potential of the module exhibited by various IPM validations on tomato. Yield realization of 2.5 times higher than traditional practices and educational trainings through FFSs guided many other farmers of adopted blocks in rating the technology to be economically profitable and sustainable. The distinct difference in crop health as a result of IPM module was demonstrated to farmers through conducting Field Days to disseminate the technology amongst farmers of adjoining villages.

Table1. Cost of IPM and Non-IPM practices at farmers fields

Work	IPM			Non - IPM		
	Man days	Cost* (Rs.)	For two years	Man days	Cost* (Rs.)	For two years
Land preparation	1	103.0	206.0	1	103.0	206.0
Transplanting	1	103.0	206.0	1	103.0	206.0
Irrigation	1	75.0	150.0	1	75.0	150.0
Weeding	1	103.0	206.0	1		
Staking/Removal of lower leaves	1	103.0	206.0			
Produced lifted by traders	1	103.0	206.0			
Spray bioagent (Spray cost + labour)	1	25+103	256.0		103.0	206.0
Pesticides HaNPV (2 spray 20 ml/spray)	1	120.0	240.0			
Picking	1	103.0	206.0	1	103.0	206.0
Total	**9**	**941.0**	**1882.0**	**5**	**487.0**	**974.0**

*As per the rates of Uttarakhand Govrnment

IPM practice

i) Land preparation weeding, irrigation, transplanting picking = 487.5x2= Rs. 974.0/demonstration of one nail.

ii) HaNPV @ 20 ml/nail (2 spray's)= 120.0 x 2= Rs. 240.0/ demonstration of one nail

iii) Trichoderma harzianum seed treatment , drenching, and foliar spray @ 1.0%= (25.0 +103.0) x 2) = Rs. 256.0/ demonstration of one nail

iv) Staking and removal of lower leaves (man day) 103.0 x 2 = Rs. 206.0 / demonstration of one nail. Lifting of the produce was lifted by the traders at farmers field at doorstep 103.0 x 2 = Rs. 206.0

Non- IPM Practice

i) Land preparation , irrigation, transplanting picking = 359.0 x 2= Rs. 718.0/demonstration of one nail

ii) Lifting of the produce was lifted by the traders at farmers field at doorstep 103.0 x 2 = Rs. 206.0

Table 3. Differential yield of tomato at IPM and non IPM plots

Blocks	IPM plots (kg/ 200 m2)	Non IPM plots (kg/ 200 m2)	%	't'
Tarikhet	377± 118*	117.3 ± 26.34	222.0	8.01***
Hawalbagh	264.7 ± 69.49	107.3 ± 10.03	146.0	7.85 ***
Dhauladevi	288 ± 88.14	119.4 ± 40.96	142.0	4.47***
Takula	410.5 ± 140.62	125.07 ± 26.936	228.0	5.61 ***
Overall	331 ± 116.39	116 ± 25.71	185.0	11.5 ***

* Mean yield and standard deviation.

*** Significant at 0.01 level of probability.

CONCLUSION

The integrated crop management along with the IPM module contributed greatly not only in attaining economically higher yield than traditional practices but highlighted some of the useful implications. In the first instance, stakeholders were exposed to the innovative technology secondly it enhanced their capacity building in conducting such validation and confidence build up in evaluation of newer technologies. Thirdly, the response of the farmers helped in understanding the dissemination dynamics of technology and further refinement of the same. Therefore, if would be ideal to replicate the success of IPM technology through Agricultural and Horticultural Functionaries of State Government and Non Government Organizations with a view to optimize tomato yield and reduce pesticide load on the crop and providing economic return to the hill farmers as well.

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REFERENCES

Arfi, M. (1997). High Altitude Insect Pests of Horticultural Crops and their Management . In : Recent Advances in Insect Pest Management in Major Crops GBPUA &T, Pantnagar, India, 141- 146.

Hooda, K.S., Bhatt, J.C., Joshi, D., Sishil, S.N. and Gupta, H.S. (2006). Biocontrol Agents vis- a- vis Fungicides in Managing Diseases of Tomato (Lycopersicon esculentum) in Kumaon Hills. Indian Phytopathology (communicated).

Krishna Kumar, N.K. and Krishna Moorthy, P.N. 2001. Integrated Pest Management of Insects Damaging Solanaceous Vegetable, pp. 35-45. In : Parvatha Reddy, Abraham Verghes and N.K. Kumar (Eds.), Pest Management in Horticulture Ecosystem. Capital Publishers, New Delhi.

Pandey, K.K. and P.K. (2003). Survey and Surveillance of Vegetable Growing Area for Prevalence of Major Diseases in This Region . Vegetable Growing Area for Prevalence of Major Diseases in This Region. Vegetable Science 30: 128- 134.

Pandey, K.K. and Pandey, P.K. and Mishra, K.K.(2005). Development and Testing of an Integrated Disease Management Package for Multiple Diseases for Tomato. Indian Phytopathology 58 (3): 294-297.

Srinivasan, P.M. (1959). Control of Fruit Borer Heliothis Armigera (Hub.) of Tomato. Indian Journal of Horticulture 16: 187-188.

Sushil, S.N.,Mohan, M., Hooda, K.S., Bhatt J.C. and Gupta, H.S. (2006). Efficacy of Safer Management Tools against Major insect Pests of Tomato and Garden Pea in Northwest Himalayas. Journal of Biological Control 20(2): 133-118.

VPKAS (2002). Technological Options for Improving Agricultural Productivity in the North Western Hill. Vivekananda Parvatiya Krishi Anusandhan Sansthan, ICAR, Almora, U.A., India 70 pp.