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Evaluating the Performance of Different Management Practices for Control of Leaf Curl Disease of Chili in Kharif Season of Chatra District in Jharkhand

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Authors' contributions

This work was carried out in collaboration among all authors. Author RKS designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors DO and UKS managed the analyses of the study. Author ZA managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

An On-farm trial (OFT) was conducted for evaluating the performance of different management practices for control of leaf curl disease of chilli in Kharif season in Chatra district of Jharkhand in two consecutive Kharif seasons of the year 2016-17 and 2017-18. The experiment was conducted in Amgawa village of Simariya block in Chatra district, where farmers generally grow Chili as a cash crop in medium land. Trial was designed in randomized block design consisting of 25 replication with three technological options i.e. TO-I: Soil application of carbofuran granule @2 gm/plant before transplanting, TO-II – TO-I: Soil application of carbofuradon granule @2 gm/plant before

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transplanting, + Spray of Spinosad 48 EC @ 2 ml/lit of water after disease incidence twice after 15 days interval and TO-III – TO-I: Soil application of carbofuradon granule @2 gm/plant before transplanting, +Spray of Acephate 75SP @ 2 ml/lit of water after disease incidence twice after 15 days interval besides farmers practices. For evaluation of the performance, percentage infestation of leaf curl disease on plant/5 sqm and yield q/ha was considered, as for economic analysis gross income, net income and B.C. ratio was calculated and compared with all treatments.
The result indicated that the minimum thrips population was found in technological option TO-III (3.35) followed by TO-II (6.45) and TO-I (6.40) respectively with a higher yield (84.5q/ha). Gross income, Net income and BC ratio was also found more in technological option TO-III. So that technology option TO-III i.e. –soil application of carbofuradone granule @ 2gram/plant before transplanting spray of acephate 75SP @ 2ml/lit of water after disease incidence twice after 15 days interval recommended considering Bio-physical and socio-economic condition of Chatra district for control of leaf curl disease for resource-rich and resource-poor farmers. This recommendation was also given to ATMA and N.G.Os of the district for faster dissemination among the farming community.

Keywords: Leaf curl disease; Chili thrips; remediation; Carbofuran; India.

1. INTRODUCTION

Chilli thrips attack all above-ground parts of its host plant, and prefers the young leaves, buds and fruits, Heavy feeding damage tunes tender leaves, buds, and fruits bronze to block in colour, damaged leaves curl upward appear distorted, infested plant become stunted or dwarfed and leaves with petioles detach from the stem, causing defoliation in some plant. The abundance of chilli trips is low in the rainy season but becomes high during the dry season.

In India area under chilli crop raised during the last three decades for fruits varies from 634 to 921 thousand hectares with total production at 364 to 895 thousand tons of dry fruits. Important Chili growing states are Andhra Pradesh, Maharastra, Karnataka, Orissa and Tamil Nadu forming more than 70 per cent of India. The per-unit production is high in the states Andhra Pradesh, Tamil Nadu where the chilli crops are raised under irrigated condition. In Jharkhand, it is grown 2.1 lakh ha area with the productivity of 160q/ha. In Chatra district Chilling is mainly grown as a cash crop by the farmers in all must all blocks of the district under 7820 ha with the productivity of 195q/ha as green chilli in the district.

Chilli growing farmers of the district suffering so may problem but the main problem is wilting and thrips attack during growth period which reduces yield and quality of the fruits. Farmers use Chlorpyrifos and dimethoate for control of chilli thrips with the different combination but they can not get better results.

Keeping this fact under consideration KVK Chatra try to know the relative efficacy of different insecticide on control of chilli thrips in the bio-physical condition of Chatra district to providing batter salutation of the commercial and resource-poor farmers of the district.

2. LITERATURE OF REVIEW

The chilli crop is infested by more than 21 insects and non-insect pests [1]. Venkatesh et al. [2] reported that chilli leaf curl was caused by leaf curl begomovirus (CLCV) transmitted by whitefly (*Bemisia tabaci*) and one of the major limiting factors in cultivation of the crop. Leaf curl virus in chilli has also been reported in India [3-6].

Senanayake et al. [7] reported that a very high disease incidence (up to 100% plants during December 2004) in farmers' fields in Narwa and Tinwari villages at Jodhpur district Rajasthan was observed. Chilli leaf curl disease complex causes huge crop losses in Jharkhand state primarily due to attack of thrips, mites and whitefly followed by the invasion of chilli leaf curl virus [8].

3. MATERIALS AND METHODS

The field experiment was conducted during 2016-17 and 2017-18 in farmers field of Amgawa village of Simariya block in Chatra district of Jharkhand where chillies are grown around the year. The soil of the village was sandy loam to sandy clay loam, analyzing low in available N and low to medium in available (9-20kg/ha) and medium to high in available K(180-192kg/ha) with P^H ranging from 5.4 to 6.5. The On-Farm

Table 1. Effect of different insecticides on average thrips population per plant during 2017-18 and 2018-19

Technology options	First spray				Mean trips population	Second spray				Mean trips population
	Pre-treatment	Post treatment				Pre-treatment	Post treatment			
		5 DAS	10 DAS	15 DAS			5 DAS	10 DAS	15 DAS	
Farmers practice	62 (8.41)	40 (6.72)	38 (6.61)	41 (6.73)	39.66	28.64 (4.98)	24.42 (3.56)	26.52 (4.95)	24.78 (4.99)	25.15
TO-I: Soil application of carbofuradon granule @2gm/plant before transplanting,	62 (8.41)	8.06 (2.92)	6.43 (2.63)	4.73 (2.28)	6.40	8.13 (2.93)	6.46 (2.63)	6.43 (2.63)	8.06 (2.92)	6.98
TO-II :TO-I: Soil application of carbofuradon granule @2gm/plant before transplanting, +Spray of Spinosad 48 EC @ 2ml/lit of water after disease incidence twice after 10 days interval	68 (4.48)	4.13 (2.15)	7.10 (2.75)	8.13 (2.93)	6.45	8.33 (2.97)	5.74 (2.51)	7.62 (2.56)	7.05 (2.64)	6.80
TO-III :TO-I: Soil application of carbofuradon granule @2gm/plant before transplanting, +Spray of Acephate 75SP @ 2ml/lit of water after disease incidence twice after 10 days interval besides.	48 (7.36)	1.68 (1.45)	5.28 (2.39)	3.09 (1.87)	3.35	8.60 (3.05)	3.98 (1.88)	4.95 (2.14)	2.48 (1.64)	3.86
CD	NS	0.15	0.03	0.24		NS	6.04	0.06	0.28	

*Note: Figure in parenthesis is square root transform value; * DAS= Days after spraying*

Table 2. Average yield and economics of different treatments for the year 2017-18 & 2018-19

Treatment	Yield (Q/ha)	Cost of Cultivation/ha	Gross income (Rs./ha)	Net income (Rs./ha)	BC ratio
Farmers practice	62	24000	62000	38000	2.58
TO-I: Soil application of carbofuradon granule @2gm/plant before transplanting,	80	29700	80000	50300	2.69
TO-II :TO-I: Soil application of carbofuradon granule @2gm/plant before transplanting, +Spray of Spinosad 48 EC @ 2ml/lit of water after disease incidence twice after 10 days interval	82	29700	82000	52300	2.76
TO-III :TO-I: Soil application of carbofuradon granule @2gm/plant before transplanting, +Spray of Acephate 75SP @ 2ml/lit of water after disease incidence twice after 10 days interval besides.	84.5	29700	84500	54800	2.84

**Families labour cost not included in the cost of cultivation*

Trials (OFT) was designed with three treatment i.e. TO-I (Technology Option) : Soil application of carbofuradon granule @2gm/plant before transplanting, TO-II – TO-I: Soil application of carbofuradon granule @2gm/plant before transplanting, +Spray of Spinosad 48 EC @ 2ml/lit of water after disease incidence twice after 15 days interval and TO-III – TO-I: Soil application of carbofuradon granule @2gm/plant before transplanting,+Spray of Acephate 75SP @ 2ml/lit of water after disease incidence twice after 15 days interval besides farmers practices. The trials were conducted on 20 replication/location in randomized block design with 2000m^2 plot size i.e. each treatment consisting 500m^2 area. In row to row and plant to plant spacing of 50x40 cm^2.Spraying was given by using a hand compression knapsack high volume sprayer during morning hours. The plot in each treatment was sprayed with respective insecticide ensuring uniform coverage of insecticide. The sprayers and accessories were thoroughly washed before changing the insecticides and also rinsed with the spray fluid of the chemical to be applied next. The first spray of insecticides was done during the vegetative phase of the crop. The second spraying of insecticides was done during the reproductive phase of the crop. Observations on the thrips incidence were recorded on day before the spraying as pre-treatment count and fifth, tenth and fifteenth after spraying as the post-treatment counts. The population of both nymphs and adults of thrips were counted during early morning hours on terminal six leaves from 5 randomly selected plants in each plot to get a representative sample of the plots.

Economics analysis of intervention technologies was done through calculation of Gross Income, Net Income, and BC Ratio of different treatments.

4. RESULTS AND DISCUSSION

Effect of different insecticides on average trips population for the year 2016-17 & 2017-18 are given in Table 1.

In all replication, before treatment thrip population is more and less equal but after treatment, it was observed a significant difference was observed in the thrips population. Table 1 mean data reveals that among the treatments, technology option III i.e. soil application of carbofuradon granule @2gm/plant before transplanting and spray of acephate 75SP @2ml/lit of water after disease incidence twice after 15 days interval recorded the mean of lowest population 3.35 and 3.86thrips/leave per plant as against 39.66 and 25.15 farmers practices. Technology option TO-II and TO-I also perform better compare to farmers practices in the biophysical and socio-economic condition of Chatra district in Jharkhand.

Similarly, Patel et al., [9] evaluated the different insecticidal treatments among them ethion + cypermethrin (0.045 per cent), methomyl (0.04 per cent) and diafenthiuron (0.05 per cent) proved to be most effective treatments. Nandini [10] also reported that the significantly minimum thrips population (0.65) thrips per 5 leaves) was recorded on the chilli plant treated with thiamethoxam and diafenthiuron (0.7 thrips per 5 leaves). Almeida [11] observed that spinosad 0.015 per cent was found most effective in reducing the population of S.dorsalis as well as in increasing yields followed by diafenthiuron 0.045 per cent. Zala et al., 2014 also reported that diafenthiuron 50WP @ 300 g.a.i./ha was highly effective in reducing the population of aphid, jassid, thrips and whitefly in cotton.

Economic of intervention technologies: Average yield and economic intervention technology are given in Table 2.

Table 2 shows that maximum yield (84.5 q/ha) was found in technology option TO-III followed by technology option TO-II i.e. (82q/ha) and technology option TO-I 80q/ha. It is almost on average 32.5% more compare to farmers practice gross income and net income was also more in technology option TO-III i.e. 84500/ha and Rs. 54800/ha as compare to technology option TO-II Rs. 82000 and 52300, Technology option TO-I Rs. 80000/ha and Rs. 50300/respectively. It is On an average (38.67%) more compared to farmers practice.

5. CONCLUSION

Leaf curler disease of Chilliis not controlled by Judicious use of chemical insecticide due to fluctuation of temperature and humidity in climate. All recommended chemical insecticide is not effective inversely in all bio-physical situation. On the basis of above finding technology option TO-III i.e. TO-I: Soil application of carbofuradon granule @2gm/plant before transplanting, +Spray of Acephate 75SP @ 2ml/lit of water after disease incidence twice after 15 days interval besides and technology option TO-II :TO-I: Soil

application of carbofuradon granule @2gm/plant before transplanting, +Spray of Spinosad 48 EC @ 2 ml/lit of water after disease incidence twice after 15 days interval is effective for control of leaf curl disease in biophysical and socio-economic condition of Chatra district of Jharkhand. Technology recommended to NGOs ATMA and other agency which involved in the transfer of technologies in the district for extrapolation among commercial resource-rich and resource-poor farmers groups.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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