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Disease management for leaf curl in Chilli

Dr. Ram Prakash Sharma, RK Verma and Dr. Bipul Mandal**Abstract**

A field trial was conducted during kharif 2019 cropping seasons. An attempt was made to find out the effective management practice through application of agrochemicals to minimize vector activities & the crop loss. Three bio rational molecules viz., Imidacloprid 17.8 SL @ 1.0 ml/3liter water, Acetamiprid 20% SP @1.0 gm/ liter water and KEM (Immunity Builder) @2.0 ml/ liter were sprayed at 15 day interval and were evaluated against vector activity to reduce the leaf curl disease incidence. The minimum disease incidence was recorded to the extent of (27.25%) coupled with highest fruit yield of 63.13 q/ha in the treatment T2 having two spraying of Acetamiprid 20% SP @1.0 gm/ liter water at an interval of fifteen days during Kharif 2019 cropping season. Maximum disease incidence (32.25%) in control with lowest yield (54.23/ha). Infection by chili leaf curl disease complex adversely affected yield attributing characters during Kharif season. Highest cost-benefit ratio of 1:11.49 was obtained by two spraying of Acetamiprid 20% SP @1.0 gm/ liter water during Kharif crop season.

Keywords: chilli, leaf curl, management, immunity builder**Introduction**

Chilli (*Capsicum annum* L.) commonly known as Mirch is an economically important and widely cultivated crop of India. It is considered as one of the most important vegetable and commercial spice crops grown throughout warm temperate, tropical and subtropical regions of the World. Chilli also called red pepper belongs to the genus *Capsicum* under the Solanaceae family. Besides traditional use of chilli as vegetables, spices, condiments, sauces and pickles it is also being used in pharmaceuticals, cosmetics and beverages (Tiwarly *et al.*, 2005) [12]. In Koshi region of Bihar, it is grown mostly in the districts of Madhepura, Supaul and Purnia etc. Although there is a scope to enhance the productivity of chilli, a number of limiting factors have been attributed to the productivity.

The damage caused by insect pests and mite is of paramount importance. Chilli is known as suffer from as many as eighty three different diseases (Anonymous, 1966) [1]. Chilli leaf curl virus is one of the major limiting factor of chilli production, which is drastically decreases yield. The significant symptoms of chilli leaf curl are Leaf crinkle or leaf curl complex was observed on chillies by Hussain, 1932. The vein clearing and leaf malformation was reported by Fernando and Pieries (1957) [3]. Curling of leaf margin, reduction in leaf size, vein clearing were observed in India, Sri Lanka and USA. Abaxial curling of the leaves accompanied by puckering, thickening and swelling of the veins were observed by Mishra *et al.* 1963 [5] and Muniyappa and Veeresh, 1984 [7]. Appearance of most prominent *et al.* symptoms such as vein clearing followed by veinal dis-tortion, swelling of veins and vein lets on dorsal side were report-ed by Muniyappa, 1980 [6] and Ravi, 1991 [11].

There were twenty four viruses reported to occur naturally on chilli, eleven viruses have been reported from India. Among all, the Chilli Leaf Curl Virus (CLCV) is the most destructive virus in terms of incidence and yield loss. In severe condition 100 per cent losses of marketable fruit have been reported by Zehra *et al.*, 2017 [16]. Venkatesh *et al.* (1998) [15] reported that chilli leaf curl complex was caused by chilli leaf curl Geminivirus (CLCV) transmitted by *Bemisia tabaci* also by thrips (*Scirtothrips dorsalis*) and mites (*Polyphagotarsonemus latus*). Chilli leaf curl disease complex causes huge crop losses in Jharkhand state primarily due to attack of thrips, mites and white fly followed by invasion of chilli leaf curl virus (Zeeshan N and Kudada N, 2019) [17]. Chilli leaf curl viral disease complex causes huge crop and yield loss in Koshi region specially in Madhepura district of Bihar because high humidity facilitate attack of thrips, mites and white fly followed by invasion of chilli leaf curl virus. The objective of this study was to evaluate different agro chemicals on vector activities to reduce chilli leaf curl disease complex.

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Materials and Methods

To assess the efficacy of three newer agrochemicals on incidence of chilli leaf curl disease complex, fruit yield and yield attributing characters, an on farm trial was conducted on ten farmers plots in different locations of Madhepura district under supervision of scientist of Krishi Vigyan Kendra during Kharif, 2019 crop season using the hybrid variety (Jwala/Bullet). There were three treatments with ten replications (farmers) in Randomized Block Design. Required concentrations of all the three agro-chemicals were sprayed twice in each plot. First foliar spraying was applied at 30 days after transplanting and second spraying was applied at 8-10 days after first spraying. Soil application of compost (20 ton/ha) and recommended doses of fertilizers N:P:K 100:60:80/ha were applied, one month old seedlings transplanted. The details of treatments were as given below:

T0: Untreated (Control) T1: Imidacloprid 7.8 SL @ 1.0 ml/3liter water, T2: Acetamiprid 20% SP @1.0 gm/ liter water and T3: KEM (Immunity Builder) @2 ml/ liter water. Affected plants were observed in each plot by recording total number of plants as well as diseased plants. Percent disease incidence was calculated by following formula suggested by Nene (1972) [8]:

$$\% \text{ Disease Incidence} = \frac{\text{No. of Diseased units}}{\text{Total no. of assessed units}} \times 100$$

Percent disease reduction was calculated by following formula:

$$\text{Percent disease reduction} = \frac{C-T}{C} \times 100$$

Where,

C - Percent disease incidence in untreated plants,

T - Percent disease incidence in treated plants.

The per cent increase of yield in treatment over control was calculated from the following formula (Vanisree *et al.*, 2013) [13].

$$\text{Per cent increase of yield in treatment over control} = \frac{\text{Yield in treatment} - \text{Yield in control}}{\text{Yield in control}} \times 100$$

The fruit yield was recorded during the entire crop season and converted to per hectare. Yield was estimated after final picking of fruits. Cost - benefit ratio was calculated by using formula as follows:

$$\text{Cost - benefit ratio} = \frac{\text{Net profit (Rs.)}}{\text{Cost of application}}$$

Net Profit = Value of additional yield over control (Rs.) – Cost of application (Rs)

Details of yield attributing characters were recorded as follows:

Plant height (cm), 2. No. of branches/plant (no.), 3. Fruit length (cm), 4. Fruit breadth (cm), 5. Fruit weight (gm). Yield attributing characters were recorded from randomly selected five plants from each farmers plot i.e. replication of each treatment at crop maturity stage.

Results and Discussion

Chilli is grown during Kharif seasons in koshi region of Bihar. The crop is attacked by many diseases. Among these, chilli leaf curl disease complex is most prevalent and devastating. Three agro chemicals viz. Imidacloprid 17.8 SL @ 1.0 ml/3liter water, Acetamiprid 20% SP @1.0 gm/ liter water and KEM (Immunity Builder) @2 ml/ liter water evaluated for their effects on vector activities, disease incidence and yield attributing characters during Kharif, 2019 cropping season.

Table 1: Effect of agro-chemicals on Chilli leaf curl virus disease incidence and green fruit yield Kharif, 2019 cropping season

Treatments	Dose	Leaf curl disease incidence (%)	Disease reduction over control (%)	Yield (q/ha)	Increase yield over control (%)
T1 – Imidacloprid 17.8 SL @ 1.0 ml/3liter water	1.0 ml/3L	29.43	8.74	61.02	12.52
T2 – Acetamiprid 20% SP @1.0 gm/ liter water.	1.0 gm/L	27.25	15.50	63.13	16.41
T3 – KEM (Immunity Builder) @2 ml/ liter water	2.0 ml/ L	30.70	4.80	57.68	6.36
T4 - Control		32.25	-	54.23	-
S.Em ±		2.193		3.483	
C.D. at 5%		6.36		10.106	
C.V. %		4.015		3.232	

The data (Table-1) revealed that all the agro-chemicals reduced the incidence of disease significantly in comparison to control. Two spraying of Acetamiprid 20% SP @1.0 gm/ liter water (T2) was recorded to be the most effective in reducing disease incidence (15.50%) coupled with highest yield (63.13q/ha) followed by Imidacloprid 17.8 SL @ 1.0 ml/3liter water (T1) disease incidence (32.25 percent) and lowest yield of 54.23 q/ha was observed in control.

The treatments T2 (Acetamiprid 20% SP) and T1 (Imidacloprid 17.8 SL) were significantly at par with each other. The maximum disease reduction over control was observed in T2 (15.50%) followed by T1 (8.74%). The increase in yield over control was highest in T2 (16.41%) followed by T1 (12.52%).

Table 2: Cost-Benefit ratio of pesticide applied Kharif 2019 cropping season

Treatments	Dose (ml/lit)	Yield (q/ha)	Additional yield over control (q/ha)	Value of additional Yield @ Rs. 2000/q	Cost of insecticidal Application (Rs.)	Net Return/ha (Rs.)	Cost benefit Ratio
T1 – Imidacloprid 7.8 SL @ 1.0 ml/3liter water	1.0 ml/3L	61.02	12.52	25040	1800+800=2600	23440	1: 9.02
T2 – Acetamiprid 20% SP @1.0 gm/ liter water.	1.0 gm/L	63.13	16.41	32820	1900+800=2700	31020	1:11.49

T3 – KEM (Immunity Builder) @2 ml/ liter water	2.0 ml/ L	57.68	6.36	12720	1600 + 800=2400	11520	1:4.80
T4 - Control		54.23	-	-	-	-	-

Rate of application: L-1

Imidacloprid 7.8 SL – RS 1600/- Acetamiprid 20% SP –RS 1800/- KEM (Immunity Builder) –RS 1200 Labour cost - Rs 800/- Rate of fruit - Rs 2000/per quintal, No. of sprayings -2 Considering the per rupee returns, application of neem seed Kernel extract Acetamiprid 20% SP @1.0 gml/lit. was highly economical which recorded cost-benefit ratio of 1:11.49 and

net return/ha of Rs.31020/- followed by application of Imidacloprid 7.8 SL recorded cost-benefit ratio of 1:9.02, respectively. Lowest cost-benefit ratio (1:4.80) was recorded in the plot treated with KEM (Immunity Builder) @2 ml/ liter water(T3) (Table 2).

Table 3: Effect of agro chemicals on yield attributing characters of chilli during Kharif 2019 cropping season

Treatments	Dose (ml/lit)	Mean plant height (cm)	Mean no. of branches/plant (No.)	Mean length/ fruit (cm)	Mean breadth/ fruit (cm)	Mean fruit Weight/plant (gm)
T1 – Imidacloprid 17.8 SL@1ml /3liter water	1.0 ml/3L	37.64	6.30	5.73	0.77	44.21
T2 – Acetamiprid 20% SP @1.0 gm/ liter water.	1.0 gm/L	39.72	6.45	6.27	0.79	44.54
T3 – KEM (Immunity Builder) @2 ml/ liter water	2.0 ml/ L	33.38	4.56	4.43	0.62	37.29
T4 - Control	-	37.69	6.23	5.51	0.76	43.83
S.Em ±		1.63	0.34	0.37	0.05	2.37
C.D. at 5%		5.08	1.12	1.17	1.17	7.24
C.V. %		8.17	14.12	12.84	14.34	10.07

Observation on the effect of agro-chemicals on yield attributing characters have been presented in Table-3. During Kharif 2019 cropping season maximum mean plant height (39.72 cm), mean no. of branches per plant (6.45), mean length per fruit (6.27 cm), mean breadth per fruit (0.79 cm)

and mean fruit weight per plant (44.54 gm) were recorded in treatment T2 (two foliar sprays of Acetamiprid 20% SP @1.0 gm/ liter water followed by T1 (two foliar sprays of Imidacloprid 17.8 SL@1ml /3liter water). All the treatments were found to be statistically superior over control.

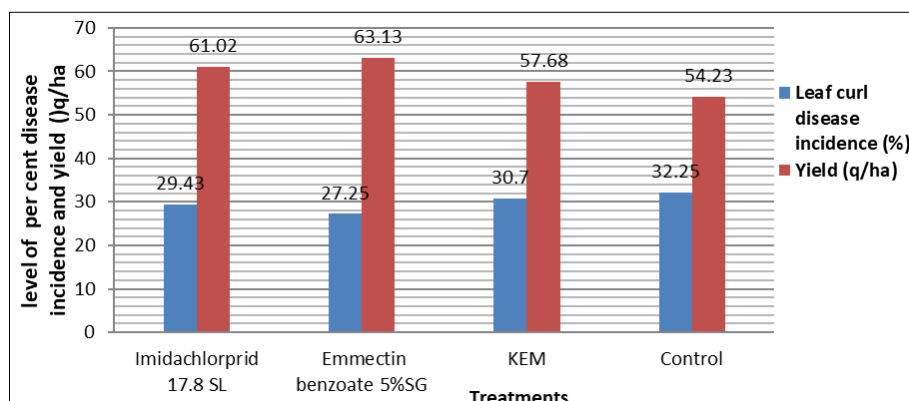


Fig 1: Effect of agro chemicals on leaf curl disease incidence and fruit yield of chilli during Kharif, 2019 cropping season

Similar results were reported by several earlier workers. The efficiency of many bio-pesticides in the management of leaf curl disease and controlling of insect pests was well documented by many workers in India on chilli crop fields (Venzon *et al.*, 2008; Pandey *et al.*, 2010; Elvis *et al.*, 2014)^[14, 9, 2]. The present investigation revealed that two spraying of Acetamiprid 20 per cent SP @1.0 gm/litre water was found to be best treatment for checking vector activity of chilli leaf curl disease complex resulting minimum leaf curl disease incidence (27.25%) coupled with highest fruit yield of 63.13 q/ha than other treatments followed by Imidacloprid 17.8 SL @ 1.0 ml/3liter water (T1) disease incidence (32.25 percent) and lowest yield of 54.23 q/ha was observed in control. In the treatment T2 having two spraying of Acetamiprid 20% SP @1.0 gm/ liter water at an interval of fifteen days. Maximum disease incidence (32.25%) in control with lowest yield (54.23/ha). Infection by chili leaf curl disease complex adversely affected yield attributing characters. Acetamiprid

20% SP @1.0 gm/ liter water was also recorded 15.50 percent disease reduction over control followed by Imidacloprid 17.8 SL @ 1.0 ml/3liter water (T1) which recorded 8.74 percent disease reduction. More or less similar findings were also reported earlier by other workers.

On the basis of overall performance, it can be concluded that among the tested agrochemicals, Acetamiprid 20% SP @1.0 gm/ liter water found most effective bio-rational pesticides for management of vector activities followed by Imidacloprid 17.8 SL @ 1.0 ml/3liter water whereas KEM (Immunity Builder) @2 ml/ liter water was found to be least effective. All three tested agrochemical significantly reduced the vector activities and effectively manage the leaf curl disease incidence as compare to control. Hence, the findings strongly recommends the application of Acetamiprid 20% SP @1.0 gm/ liter water against vector activities to reduce the leaf curl virus disease complex in chilli crop during Kharif season.

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