Mysore J. Agric. Sci., 52 (3) : 566-573 (2018)

Management of Mungbean Yellow Mosaic Virus Disease in Mungbean

CHIRAG GAUTAM AND H. K. RAMAPPA
Department of Plant Pathology, College of Agriculture, UAS, GKVK, Bengaluru - 560 065
E-mail : chirag19111911@gmail.com

ABSTRACT

A field experiment was conducted during summer 2016-17 to evaluate the effect of border crop, seed treatment and foliar spray with neem based formulation or different insecticides as IDM approach for the management of yellow mosaic disease of mungbean. Seed treatment with imidacloprid 48 FS @ 5.0 ml/kg seed + one spray with imidacloprid 17.8 SL @ 0.24 ml/l was found to be statistically superior in reducing the disease incidence over control by 56.37 per cent with least mean whitefly population (2.58/plant) which was significantly lesser than control (6.59/plant). Same treatment also recorded maximum no. of pods/ plant (19.70) with maximum yield of 1095 kg/ha followed by seed treatment with imidacloprid 48 FS @ 5.0 ml/kg seed + one spray with triazophos 40 EC @ 1.5 ml/l with a yield of 1022.50 kg/ha. Untreated plot recorded highest mean disease incidence of 40.13 per cent with minimum yield of 601.50 kg/ha.

Keywords: MYMV, Whitefly, IDM, Mungbean, Imidacloprid

PULSES share a major part of the dietary protein. Mungbean [*Vigna radiata* (L.) Wilczek] is the third important tropical pulse crop after chickpea and pigeon pea in India (Cayalvizhi *et al*., 2015). It is an excellent source of protein (24.5%) with a high quality of lysine (460 mg/g N) and tryptophan (60 mg/g N). It has also a remarkable quantity of ascorbic acid when sprouted and also contains riboflavin (0.21 mg/100g) and minerals (3.84 g/100g). It is native to India-Burma region of South-East Asia and grown during *kharif* (July-October) and summer (March- June) seasons in arid and semi-arid regions of India (Meena *et al*., 2016).

In India, mungbean is grown over an area of 3.38 mha with an average production of 1.61 mt and productivity of 0.47 t/ha in the year 2013-14. In Karnataka, it is grown over an area of 0.32 mha with a production of 0.81 mt and productivity of 0.25 t/ha (Anon., 2014). Yellow mosaic disease caused by Mungbean Yellow Mosaic Virus (MYMV) is one of the tallest barricades in the way of increasing production and productivity of mungbean.

MYMV disease in mungbean was first ever reported by Nariani from New Delhi in 1960. It is a Begomovirus of the family Geminiviridae and is transmitted principally by whitefly, *Bemisia tabaci* (Genn.) in nature. Grafting is another way of transmitting this virus from diseases to healthy plant but it is not transmitted by sap, seed or soil. MYMV causes irregular green and yellow patches in older leaves and complete yellowing of younger leaves. Affected plants produce fewer flowers and pods, pods often develop mottling, remain small and contain fewer and smaller seeds thus affecting yields qualitatively and quantitatively. Reduction in number of pods/plant, seeds/pod and seed weight are the main contributing factors for yield reduction (Nariani, 1960).

Virus diseases are difficult to manage through any single approach. Thus integration of different approaches always proved to be promising in sustainable management of vector borne diseases. With this background, a field study was carried out during summer seasons of 2016-17 to evaluate effect of border crop, neem based formulation and different

insecticides as seed treatment and/or foliar spray on the management of MYMV in mungbean.

Material and Methods

Details of the experiment

A field experiment was conducted during summer season of 2016-17 at ZARS, V. C. Farm, Mandya to know the effective disease management module for MYMV in mungbean. Mungbean variety KKM-3 was used since it is susceptible to MYMV. The net plot size of 4.0 × 4.0 m^2 was maintained for each treatment with 30 cm distance between rows and 10 cm between plants. All standard agronomic practices were followed. Maize as border crop (var. African tall) was sown 15 day prior to mungbean sowing. Two sprays were taken up after 15 and 30 days of sowing and single spray, after 15 days of sowing. Disease incidence was recorded at 15, 30 and 60 DAS in each treatment by counting the diseased plants and the per cent disease incidence was calculated. Yield data were recorded separately for each treatment after the crop harvest. Total of 14 treatments were selected and laid out as per Randomized Complete Block Design (RCBD).

Per cent disease incidence

Per cent disease incidence was calculated by counting number of plants infected and total number of plants in a plot. The readings were recorded at 15 days intervals before and after the spray and data were analyzed statistically.

$$\text{Per cent disease incidence} = \frac{\text{Number of infected plants in a row}}{\text{Total number of plants in a row}} \text{ X } 100$$

The per cent disease reduction over control was calculated by using the formula given by Vincent (1947).

$$\text{Per cent disease reduction} = \frac{(C-T)}{C} \text{ X } 100$$

Where,

C = Per cent disease in control

T = Per cent disease in treatment

Vector population

The whiteflies population was recorded by considering top 3 trifoliate leaves at one day before and 5 days after first and second sprays in randomly selected five plants in each treatment. Observations were subjected to statistical analysis to assess the impact of different treatments on vector population. Per cent reduction over control was calculated by using following formula

$$\text{Per cent reduction over control} = \frac{\text{No. of whiteflies in control - No. of whiteflies in treatment}}{\text{No. of flies in control}} \text{ x } 100$$

Growth and yield parameters

In each trial plot, five plants were selected (at harvesting stage) randomly for assessing growth and yield parameters. The effect of MYMV on plant height, pods per plant and yield per ha was studied and five plants average data was analysed statistically.

Statistical analysis

Analysis and interpretation of experimental data performed as per RCBD.

Treatment details are as follows

T_1 Maize as border row (1 row)

T_2 Seed treatment with imidacloprid 48 FS (5.0 ml/kg seed)

T_3 Seed treatment with thiamethoxam 70 WS (5.0 g/kg seed)

T_4 Two sprays with imidacloprid 17.8 SL (0.24 ml/l)

T_5 Two sprays with triazophos 40 EC (1.25 ml/l)

T_6 Two sprays with azadirachtin 0.03 EC (5 ml/l)

T_7 Maize as border row (1 row) + one spray with imidacloprid 17.8 SL (0.24 ml/l)

T_8 Seed treatment with imidacloprid 48 FS (5.0 ml/kg seed) + one spray with imidacloprid 17.8 SL (0.24 ml/l)

T_9 Seed treatment with thiamethoxam 70 WS (5.0 g/kg seed) + one spray with imidacloprid 17.8 SL (0.24 ml/l)

T_{10} Seed treatment with imidacloprid 48 FS (5.0 ml/ kg seed) + one spray with triazophos 40 EC (1.5 ml/l)

T_{11} Seed treatment with thiamethoxam 70 WS (5.0 g/kg seed) + one spray with triazophos 40 EC (1.5 ml/l)

T_{12} Seed treatment with imidacloprid 48 FS (5.0 ml/ kg seed) + one spray with azadirachtin 0.03 EC (5 ml/l)

T_{13} Seed treatment with thiamethoxam 70WS (5.0 g/kg seed) + one spray with azadirachtin 0.03 EC (5 ml/l)

T_{14} Untreated check

Results and Discussion

Effect of different treatments on mungbean yellow mosaic virus (MYMV) incidence

The experimental results revealed that there was significant difference between the treatments as compared to control (Table 1). Lowest mean disease incidence of 20.87 per cent was recorded in seed treatment with imidacloprid 48 FS @ 5.0 ml/kg seed+ one spray with imidacloprid 17.8 SL @ 0.24 ml/l (T_8) which was followed by seed treatment with imidacloprid 48 FS @ 5.0 ml/kg seed + one spray with triazophos 40 EC @ 1.5 ml/l (T_{10}), seed treatment with thiamethoxam + one spray with imidacloprid (T_9) and seed treatment with thiamethoxam 70 WS @ 5.0 g/kg seed + one spray with triazophos 40 EC @ 1.5 ml/l (T_{11}) with mean per cent disease incidence of 22.09, 22.77 and 22.96 respectively. Highest mean per cent disease incidence of 40.13 was recorded in untreated plot. Amongst the treatments, the highest mean per cent disease incidence was recorded in Maize as border row (1 row) with 34.16 per cent (T_1) followed by two sprays with azadirachtin 0.03 EC @ 5 ml/l with 29.03 per cent (T_6). Mean disease incidence was higher in plot with border crop *i.e.*, T_1 (34.16 %), whereas T_1+ one spray with imidacloprid @ 0.24 ml/l (T_7) showed lower disease incidence (27.40 %) compared to T_1 alone. While seed treatment with imidacloprid 48 FS @ 5.0 ml/kg (T_2) seeds and thiamethoxam @ 5 g/kg seeds (T_3) recorded mean disease incidence of 27.91 and 27.65 per cent respectively which were found to be superior compared to untreated plot (40.13 %).

Seed treatment with imidacloprid (T_2, T_8, T_{10} and T_{12}) and thiamethoxam (T_3, T_9, T_{11} and T_{13}) were found to be effective in reducing the disease incidence at 15 DAS (Days After Sowing). Per cent disease incidence was recorded lowest in T_2 (11.90%) followed by T_8 (11.73%) in which seeds were treated with imidacloprid @ 0.24 ml/l. Untreated plot was recorded with disease incidence of 15.00 per cent.

Foliar spray with imidacloprid (T_8 and T_9) and triazophos (T_{10} and T_{11}) at 15 DAS in seed treated plots were recorded less per cent disease incidence at 30 DAS compare to other treatments. Amongst all the treatments, T_8 (19.40%) was found to be effective where seeds were treated with imidacloprid 48 FS @ 5.0 ml/kg seed followed by one spray of imidacloprid 17.8 SL @ 0.24 ml/l. Next effective treatment was seed treatment with imidacloprid + one spray with triazophos (T_{10}) which recorded disease incidence of 22.10 per cent compare to control (43.64%).

At 60 DAS, the results followed same pattern were recorded, where seed treatment followed by one foliar spray with insecticides was found more effective in curbing the disease incidence. Disease incidence was found to be significantly less in T_8 (31.50%) followed by T_{10} (31.75%), T_{11} (32.05%) and T_9 (32.40%). Whereas statistical analysis revealed that T_8 and T_{10} were on par with each other. Two sprays with either imidacloprid (T_4) or triazophos (T_5) at 15 DAS and 30 DAS were found next effective treatments as they recorded a per cent disease incidence of 34.05 and 34.45, respectively at 60 DAS.

Seed treatment with imidacloprid @ 5.0 ml/kg seed + one spray with imidacloprid @ 0.24 ml/l recorded 56.37 per cent disease decrease over control followed by T_{10} (53.83%).

Mungbean plants at seedling stage are more vulnerable for MYMV incidence because such plants are tender and thus more prone to whitefly infestation. Imidacloprid, a neonicotinoid is a systemic insecticide

TABLE 1

Effect of different treatments on MYMV disease incidence in mungbean during summer 2017

Treatments	Treatment details	Per cent Disease Incidence				% Decrease over control
		15 DAS	30 DAS	60 DAS	Mean	
T_1	Maize as border row	14.60 (22.45)*	34.50 (35.95)	53.40 (46.93)	34.16	28.61
T_2	Seed treatment with imidacloprid	11.90 (20.17)	27.65 (31.71)	44.20 (41.65)	27.91	41.67
T_3	Seed treatment with thiamethoxam	13.11 (21.21)	28.05 (31.96)	41.80 (40.26)	27.65	42.22
T_4	Two sprays with imidacloprid	14.95 (22.73)	26.85 (31.19)	34.05 (35.68)	25.28	47.17
T_5	Two sprays with triazophos	15.10 (22.85)	26.35 (30.87)	34.45 (35.92)	25.30	47.13
T_6	Two sprays with azadirachtin	14.75 (22.57)	28.00 (31.93)	44.35 (41.73)	29.03	39.33
T_7	Maize as border row (1 row) + one spray with imidacloprid	14.32 (22.23)	26.85 (31.19)	41.05 (39.82)	27.40	42.73
T_8	Seed treatment with imidacloprid + one spray with imidacloprid	11.73 (20.02)	19.40 (26.12)	31.50 (34.12)	20.87	56.37
T_9	Seed treatment with thiamethoxam + one spray with imidacloprid	13.36 (21.43)	22.55 (28.33)	32.40 (34.68)	22.77	52.42
T_{10}	Seed treatment with imidacloprid + one spray with triazophos	12.43 (20.63)	22.10 (28.02)	31.75 (34.28)	22.09	53.83
T_{11}	Seed treatment with thiamethoxam + one spray with triazophos	13.45 (21.50)	23.40 (28.91)	32.05 (34.46)	22.96	52.01
T_{12}	Seed treatment with imidacloprid + one spray with azadirachtin	12.17 (20.41)	25.65 (30.41)	37.55 (37.77)	25.12	47.50
T_{13}	Seed treatment with thiamethoxam + one spray with azadirachtin	13.35 (21.42)	26.15 (30.74)	37.10 (37.50)	25.53	46.64
T_{14}	Untreated check	15.00 (22.77)	43.64 (41.32)	61.75 (51.77)	40.13	
	SEm±	0.304	0.292	0.422	1.460	
	C.D at 5%	0.930	0.893	1.289	4.245	
	CV%	1.991	1.310	1.529	8.248	

*Figures in parenthesis are angular transformed values, DAS = Days after sowing.

which has been reported as effective chemical to manage the whitefly population. The effective treatment in present study comprises seed treatment with imidacloprid and one spray with imidacloprid just after 15 DAS. Seed treatment followed by one spray protects the young plants by minimizing the population of whiteflies and thus reduces the percent disease incidence.

The results are in agreement with the findings of Jayappa *et. al*., 2017 who reported that the seed treatment with imidacloprid at 5 ml/kg seeds and two sprays of imidacloprid at 0.5 ml/l at 25 and 40 days after sowing (DAS) or two sprays of imidacloprid at 0.5 ml/l alone at 25 and 40 DAS were found effective in reducing the incidence of MYMV (41.86%).

Effect of different treatments on whitefly population

Results of present investigation on management of whitefly transmitted MYMV revealed the significant difference between the treatments compared to control (Table 2). Lowest mean population of vector was recorded in imidacloprid 48 FS @ 5.0 ml/kg seed (T_2) with 3.01 whiteflies/plant at one day before the foliar spray (1 DBS), which was followed by seed treatment with imidacloprid 48 FS @ 5.0 ml/kg seed+ one spray with imidacloprid 17.8 SL @ 0.24 ml/l (T_8), seed treatment with thiamethoxam 70 WS @ 5.0 g/kg seed + one spray with triazophos 40 EC @ 1.5 ml/l (T_{11}), seed treatment with imidacloprid 48 FS @ 5.0 ml/kg seed+ one spray with triazophos 40 EC @ 1.5 ml/l (T_{10}), seed treatment with imidacloprid 48 FS @ 5.0 ml/kg seed+ one spray with azadirachtin 0.03 EC @ 5 ml/l (T_{12}), seed treatment with thiamethoxam

TABLE 2

Effect of different treatments on whitefly population in mungbean during summer 2017

Treatments	Treatment details	Whitefly population				% Decrease over control
		1 DBS	5 DAFS	5 DASS	Mean	
T_1	Maize as border row	4.51 (2.12)*	4.39 (2.10)	5.50 (2.35)	4.80	27.19
T_2	Seed treatment with imidacloprid	3.01 (1.73)	3.35 (1.83)	3.40 (1.84)	3.25	50.63
T_3	Seed treatment with thiamethoxam	3.30 (1.81)	3.58 (1.89)	3.58 (1.89)	3.48	47.17
T_4	Two sprays with imidacloprid	3.63 (1.90)	3.60 (1.90)	3.10 (1.76)	3.44	47.77
T_5	Two sprays with triazophos	5.18 (2.27)	4.85 (2.20)	3.30 (1.82)	4.44	32.63
T_6	Two sprays with azadirachtin	5.55 (2.35)	5.44 (2.33)	4.60 (2.14)	5.20	21.17
T_7	Maize as border row (1 row) + one spray with imidacloprid	4.58 (2.14)	4.19 (2.05)	3.70 (1.92)	4.16	36.92
T_8	Seed treatment with imidacloprid + one spray with imidacloprid	3.05 (1.74)	2.65 (1.63)	2.05 (1.43)	2.58	60.82
T_9	Seed treatment with thiamethoxam + one spray with imidacloprid	3.21 (1.79)	3.09 (1.76)	2.50 (1.58)	2.93	55.51
T_{10}	Seed treatment with imidacloprid + one spray with triazophos	3.13 (1.76)	3.02 (1.74)	2.55 (1.60)	2.90	56.04
T_{11}	Seed treatment with thiamethoxam + one spray with triazophos	3.11 (1.76)	3.00 (1.73)	2.65 (1.63)	2.92	55.74
T_{12}	Seed treatment with imidacloprid + one spray with azadirachtin	3.13 (1.76)	3.02 (1.74)	2.93 (1.71)	3.03	54.10
T_{13}	Seed treatment with thiamethoxam + one spray with azadirachtin	3.17 (1.78)	3.11 (1.76)	3.45 (1.86)	3.24	50.78
T_{14}	Untreated check	5.99 (2.44)	6.39 (2.53)	7.40 (2.72)	6.59	
	SEm±	0.017	0.031	0.040	0.064	
	C.D at 5%	0.054	0.097	0.123	0.188	
	CV%	1.291	2.31	3.040	5.833	

* Figures in the parentheses are square root transformed values. DBS = Days before sowing, DAFS = Days after first spray, DASS = Days after second spray

70WS @ 5.0 g/kg seed + one spray with azadirachtin 0.03 EC @ 5 ml/l (T_{13}) and seed treatment with thiamethoxam 70 WS @ 5.0 g/kg seed + one spray with imidacloprid 17.8 SL @ 0.24 ml/l (T_9) in which seeds were treated with different insecticides. Untreated plot recorded highest vector population (5.99 whiteflies/plant), while maize as border crop recorded on an average 4.51 whiteflies/plant.

After five days of first foliar spray, T_8 recorded lower number of whiteflies per plant (2.65 whiteflies/plant) which was followed by T_{11} (3.00 whiteflies/plant). Combination of maize as border row + one spray with imidacloprid 17.8 SL @ 0.24 ml/l reduced the vector population (4.19 whiteflies/plant) compared to maize as border crop alone (4.39 whiteflies/plant). Among all the treatments highest vector population was observed in control plot (6.39 whiteflies/plant).

After five days of second spray, T_8 (2.05 whiteflies/plant) recorded lowest whitefly population, followed by T_9 (2.50 whiteflies/plant), T_{10} (2.55 whiteflies/plant) and T_{11} (2.65 whiteflies/plant). Hence, seed treatment with imidacloprid 48 FS @ 5.0 ml/kg seed+ one spray with imidacloprid 17.8 SL @ 0.24 ml/l was found to be best treatment in reducing vector population with per cent reduction of 60.82 over control.

Whiteflies are small hemipterans insects which feed on under side of the leaves by sucking the plant juice. They spread the MYMV and are only known vector of this virus. Effective management of whiteflies by use of insecticides must include a systemic insecticide. Imidacloprid which is a neonicotinoid, has been reported by several workers as effective systemic insecticide to manage the whitefly population. The results of present study revealed that seed treatment followed by one spray with insecticides more specifically imidacloprid reduces the whitefly population in initial stage of plant growth. The results are in conformity with Swathi and Neeta Gaur, 2017 who reported that seed treatment with thiamethoxam 30FS @ 5ml/kg seed, foliar application of imidacloprid 17.8 SL @ 500ml/ha at 30-35 DAS and triazophos 40 EC @ 800 ml/ha at 45-50 DAS reduced the mean whitefly population (1.02 whiteflies/plant).

Effect of different treatments on growth parameters

The effect of various treatments on growth and yield parameters *viz.,* plant height, pods per plant and yield/ha were evaluated (Table 3). It is evident from the trial that the treatments which were recorded least per cent disease incidence and whitefly population with a significant positive effect on all the growth and yield parameters evaluated. There was no significant difference observed among all treatments with regard to plant height. However, the plant height varied from 35.60 to 37.10 cm (Table 3). Previous workers also reported that the infected plants produced fewer pods with immature and deformed seeds, thus affecting the yield both qualitatively and quantitatively (Karthikeyan *et al.,* 2014).

Number of pods

Seed treatment with imidacloprid 48 FS @ 5.0 ml/kg seed+ one spray with imidacloprid 17.8 SL @ 0.24 ml/l (T_8) showed higher number of pods/plants (19.70) which was followed by seed treatment with thiamethoxam 70 WS @ 5.0 g/kg seed + one spray with triazophos 40 EC @ 1.5 ml/l (T_{11}) with 19.00 pods/plant and seed treatment with imidacloprid 48 FS @ 5.0 ml/kg seed+ one spray with triazophos 40 EC @ 1.5 ml/l (T_{10}) with 18.70 pods/plant. Untreated check recorded lower number of pods/plant (13.10).

Due to MYMV disease incidence, there is a lesser photosynthetic area because of which number of pods might have reduced. Similar results were obtained by Rajnish *et al.* (2006) who reported an average reduction of 24.76 per cent pods/plant and 25.28 per cent reduction in yield per plant in mungbean against MYMV.

Effect of different treatments on yield

Significant difference with respect to the yield was observed in treated plants when compared to untreated control (Table 3). Among all the treatments, seed treatment with imidacloprid 48 FS @ 5.0 ml/kg seed + one spray with imidacloprid 17.8 SL @ 0.24 ml/l (T_8) recorded highest yield of 1095 kg/ha which was followed by T_{10} (seed treatment with imidacloprid

TABLE 3

Effect of different treatments on growth parameters in mungbean during summer 2017

Treatments	Treatment details	Growth Parameters			% Increase over control
		Plant height (cm)	Number of pods	Yield Kg/ha	
T_1	Maize as border row	36.90	15.90 (3.98)*	825.50	27.13
T_2	Seed treatment with imidacloprid	36.90	16.10 (4.01)	837.50	28.17
T_3	Seed treatment with thiamethoxam	36.70	15.10 (3.88)	827.00	27.26
T_4	Two sprays with imidacloprid	36.70	17.20 (4.14)	992.50	39.39
T_5	Two sprays with triazophos	36.70	17.40 (4.16)	927.50	35.14
T_6	Two sprays with azadirachtin	36.40	16.80 (4.09)	802.00	25.00
T_7	Maize as border row (1 row) + one spray with imidacloprid	36.40	15.20 (3.89)	847.50	29.02
T_8	Seed treatment with imidacloprid + one spray with imidacloprid	37.10	19.70 (4.43)	1095.00	45.06
T_9	Seed treatment with thiamethoxam + one spray with imidacloprid	36.70	16.30 (4.03)	898.50	33.05
T_{10}	Seed treatment with imidacloprid + one spray with triazophos	36.70	18.70 (4.31)	1022.50	41.17
T_{11}	Seed treatment with thiamethoxam + one spray with triazophos	36.40	19.00 (4.35)	977.50	38.46
T_{12}	Seed treatment with imidacloprid + one spray with azadirachtin	36.60	15.70 (3.96)	862.50	30.26
T_{13}	Seed treatment with thiamethoxam + one spray with azadirachtin	36.30	15.00 (3.86)	853.00	29.48
T_{14}	Untreated check	35.60	13.10 (3.61)	601.50	
	SEm±	0.122	0.438	3.892	
	C.D at 5%	0.373	1.338	11.891	
	CV%	4.265	1.693	6.622	

* Figures in the parentheses are square root transformed value

48 FS @ 5.0 ml/kg seed one spray with triazophos 40 EC @ 1.5 ml/l) with yield of 1022.50 kg/ha. Two sprays with imidacloprid 17.8 SL @ 0.24 ml/l (T_4) and T_{11} (seed treatment with thiamethoxam 70 WS @ 5.0 g/kg seed + one spray with triazophos 40 EC @ 1.5 ml/l) were recorded next best with yield of 992.50 and 977.50 kg/ha, respectively. Between treatments, higher per cent yield increase over control of 45.06 per cent was recorded in T_8 (seed treatment with imidacloprid 48 FS @ 5.0 ml/kg seed) + one spray with imidacloprid 17.8 SL @ 0.24 ml/l) whereas least was recorded in two sprays with azadirachtin 0.03 EC @ 5 ml/l (T_6) with 25 per cent yield increase over control. However lower yield was recorded in untreated check (601.50 kg/ha). The results are in confirmation with Dubey and Birendra Singh (2014) who showed that combination of seed treatment and foliar spray with insecticides increases the grain yield in mungbean.

MYMV disease incidence leads to yellowing, puckering and size reduction of the leaves, which results

in lesser photosynthetic area. It paves the way for production of less number of pods/plant. Eventually, the amount of photosynthates to be accumulated as grain in the pods gets reduced which results in reduced yield. Initial protection of the plants from whitefly infestation and thus MYMV incidence, leads to healthy crop canopy which produces more number of pods and thus more yield.

The results showed that seed treatment followed by foliar spray with insecticides gave promising results in reducing the mungbean yellow mosaic virus disease incidence. Based on field data it can be concluded that seed treatment with imidacloprid 48 FS @ 5.0 ml/kg seed + foliar spray with imidacloprid 17.8 SL @ 0.24 ml/l was found to be effective in controlling the whitefly population and subsequently the MYMV disease incidence. This treatment does not only increased the no. of pod/plant but also the grain yield. As whitefly is the only known vector for the MYMV spread in nature, the control of its population is necessary to manage MYMV incidence. The farmers solely rely upon insecticides to manage the pests. Broad spectrum insecticides such as organophosphates, carbamates and pyrethroids have been used to control the whitefly since long time. But, they are highly toxic to humans and beneficial organisms. Neonicotinoids like Imidacloprid and thiamethoxam cause less toxicity in birds and mammals compare to carbamates and organophosphates. Thus this model of management of MYMV can be adopted by the farmers.

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(*Received :* May, 2018 *Accepted :* August, 2018)