RESEARCH NOTE

Efficacy of Various Integrated Pest Management Methods Against Incidence of Whiteflies (*Bemisia tabaci* Genn.) and Occurrence of Yellow Mosaic Virus (YMV) Disease of Urdbean in Bundelkhand Region

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ABSTRACT

Mungbean yellow mosaic virus (MYMV) disease is one of the most vicious diseases of black gram and has been renowned in India for more than five decades. The economic losses due to this virus account up to 85% in black gram and spreading faster towards newer areas. Field experiments were carried out during the Kharif *season of 2015 and 2016 by Krishi Vigyan Kendra, Datia, Madhya Pradesh to evaluate the five integrated pest management module with conventional farmers' practices against black gram sucking pest (white fly) and YMV under on farm testing activity of the KVK at farmers' field. Among the test modules, Module 4 (Resistant variety PU-31+ Spray with Azadirachtin, 0.03% after 15 and 30 days of sowing + by Thiamethoxam 25% WG @ 0.2 g/lt WG after 45 day of sowing) followed by Module 5 where Imidacloprid 17.8% SL @ 0.3 g/lt using in place of Thiamethoxam 25% WG were found as the most effective treatments with more than 91 per cent mean reduction in nymphal population of whiteflies and below 1 per cent incidence of YMV. All the IPM modules were found significantly superior over the conventional farmers' practices in reducing the incidence of YMV in black gram. Higher mean yield of 11.28 q/ha in Module 4 followed by Module 5, Module 1, Module 2 and Module 3 were recorded in the IPM fields against 7.08 q/ha in farmers' practise fields. Module 4 obtained maximum return with higher benefit cost ratio followed by Module 5, Module 1, Module 2 and Module 3.*

***Key words:** White fly; MYMV; Disease incidence; Resistant variety;*

Black gram (*Vigna mungo* L.) is important native pulse crop of India (*Vavilov, 1926*) and is grown under mono, mixed and multiple cropping systems during rainy (*kharif*), spring and summer seasons under wide range of agro-climatic conditions. The productivity of Black gram is very low in Bundelkhand agro-climatic zone due to its cultivation on marginal lands under poor management. The major constraints responsible for lower yield potential are broadcast method of sowing and usage of Mungbean yellow mosaic virus (MYMV) susceptible local varieties. Among the number of constraints, whitefly, *Bemisia tabaci* (Gennadius) besides causing direct damage as a sucking pest, it transmits a Gemini virus i.e. Mungbean Yellow Mosaic Virus (MYMV) in black gram. MYMV disease is one of the most vicious diseases of black gram and yield losses due to this disease varied from 5 to 100 per cent depending upon the crop age, disease severity and susceptibility of cultivars and population of whitefly (*Rathi 2002*).

The initial symptoms of the yellow mosaic disease in black gram appear in the forms of irregular yellow patches of various sizes, which coalesce to form larger patches of bright yellow colour. This is accompanied with general stunting of plants (*Qazi et al., 2007*). In severe cases almost entire leaves may turn yellow, plants bear few flowers and pods are smaller with immature seeds.

Though, many options are available for the management of whitefly population and consequent reduction in YMV disease incidence. Farmers are mostly using synthetic chemicals because of their quick knock-down effect with or without knowing the ill effects of these chemicals. To minimize the use of hazardous chemicals, IPM strategies are suggested to avoid toxicity to human health, environment and beneficial insects. The objective of present study was to evaluate and demonstrate the performance of integrated pest management modules against sucking pests of black gram as well as yellow mosaic disease under field condition.

METHODOLOGY

Field experiments were carried out during the *Kharif* season of 2015 and 2016 by Krishi Vigyan Kendra, Datia, Madhya Pradesh to evaluate the five integrated pest management module with conventional farmers' practice against black gram sucking pest (whitefly) and MYMV under farm testing activity of the KVK at farmers' field. All the recommended cultural and agronomical practices were followed to raise a healthy crop. Following treatment modules were conducted and compared:

- T- 1: Resistant variety PU-31+ Spray with Neem oil (Azadirachtin, 0.03%) after 15 and 30 days after sowing.
- T- 2: Resistant variety PU-31+ Spray with Thiamethoxam 25% WG @ 0.2 g/lt after 30 days of sowing.
- T- 3: Resistant variety PU-31+ Spray with Imidacloprid 17.8% SL @ 0.3 g/lt after 30 days of sowing.
- T-4: Resistant variety PU-31+ Spray with Azadirachtin, 0.03% after 15 and 30 days of sowing + Thiamethoxam 25% WG @ 0.2 g/lt after 45 days of sowing.
- T-5: Resistant variety PU-31+ Spray with azadirachtin, 0.03% after 15 and 30 days of sowing + Imidacloprid 17.8% SL @ 0.3 g/lt after 45 days of sowing.
- T-6: Conventional farmers' practices.

Sprays were conducted at starting with the initiation of insect pests by using knapsack sprayer at 500 l of spray fluid/ ha. For white flies, three trifoliate leaves each from top, middle and bottom canopies were taken into a polythene cover from ten plants in each treatment. The samples were taken to the laboratory and the live nymphal population count was taken using stereo zoom microscope. Data on pest population was recorded one day before spraying as pre treatment count and post treatment counts were taken at 3 and 5 days after spraying. The observations were recorded from ten randomly selected plants in each plot leaving the border rows. Per cent disease incidence of YMV was recorded from the whole plot at 60 days after sowing from all the treatments.

RESULTS AND DISCUSSION

On farm evaluation of black gram IPM modules were carried out at the farmer's field. The results showed that all IPM modules tested were found significantly superior over the untreated (control) in terms of protection and production The mean data pertaining to the efficacy of different treatments in reducing the whitefly population showed that, module 4 (T- 4) was the most effective treatment among all the test modules which recorded lowest white flies population (0.21 per leaf /plant) and around 96 per cent reduction in nymphal population of whiteflies over untreated control. The next best treatment in reducing the whitefly nymphal population was module 5 (T- 5) with around 95 per cent mean reduction over farmers' practices and recorded 0.27 per leaf/plant nymphal population followed by module 1 (T- 1), around 85.67 percent; module 2, 83.90 per cent and module 3 showed 81.80 per cent reduction in white flies population.

The incidence of Yellow mosaic virus (YMV) disease was recorded at 60 days after sowing. Module 4 was found 0.80 per cent disease incidence (reduced 96.23%) which is significantly superior over the rest of the modules. However, it was found statistically at par with module 5 which was found 1.0 per cent disease incidence and 95.28 per cent reduction in disease incidence against farmer practices. The remaining insecticidal treatments showed more or less similar efficacy against YMV without significant differences. However, all the treatments were found significantly superior over the untreated control in reducing the incidence of YMV in black gram (Table.1).The results obtained in the present study were in accordance with *Seetharamu et al. (2011),* who reported that the incidence of YMV was low in insecticide treated plots compared to the untreated plots. Similarly, *Ghosh et al (2009),* reported that Imidacloprid and Thiamethoxam were more effective in reducing the incidence of YMV when compared to conventional insecticides. Findings of *Mandal and Mandal (2010), Dubey and Singh (2010)* also reported that Imidacloprid and Thiamethoxam were significantly superior in efficacy against sucking insect pests. *Patel et al. (2010)* also

Table 1. Incidence of whitefly and MYMV in different management module of black gram (Pooled data of Kharif 2015 and 2016)

Treatments	*Nymphal	**Mean reduction[2]	YMV incidence(%)	Per cent reduction	Yield (q/ha.)
Module 1: Resistant variety PU-31+ Spray with Neem oil (Azadirachtin, 0.03%) after 15 and 30 days after sowing.	0.89	85.67	3.40(10.62)	83.96	10.64
Module 2: Resistant variety PU-31+ Spray with Thiamethoxam 25% WG @ 0.2 g/lt after 30 days of sowing.	1.00	83.90	3.80(11.24)	82.07	10.30
Module 3: Resistant variety PU-31+ Spray with Imidacloprid 17.8% SL @ 0.3 g/lt after 30 days of sowing.	1.13	81.80	4.20(11.83)	80.19	9.86
Module 4: Resistant variety PU-31+ Spray with Azadirachtin, 0.03% after 15 and 30 days of sowing + Thiamethoxam 25% WG @ 0.2 g/lt after 45 days of sowing.	0.21	96.62	0.80(5.13)	96.23	11.36
Module 5: Resistant variety PU-31+ Spray with azadirachtin, 0.03% after 15 and 30 days of sowing + Imidacloprid 17.8% SL @ 0.3 g/lt after 45 days of sowing.	0.27	95.65	1.00(5.74)	95.28	11.10
Module 6: Conventional farmers' practices (unidentified variety + Non judicious use of insecticide)	6.21	—	21.2(27.41)	-	7.06
SE (±)	0.008		0.834		0.094
CD at 5%	0.0268		2.461		0.280

Figures in the parenthesis are the angular transformed values.

*Nymphal population of whiteflies (per leaf/plant)

**Mean reduction in nymphal population of white flies (%)

Table 2. Detail of Economics of treatments (Pooled data of Kharif 2015 and 2016)

Treatment	Yield (q/ha)	Yield increase (%)	Cost of treatment (Rs.)	Gross return	Net Return(Rs)	B:C ratio
Module 1	10.64	50.28	17700	58520	40820	3.31
Module 2	10.30	45.48	17600	56650	39050	3.22
Module 3	9.86	39.27	17600	54230	36630	3.08
Module 4	11.36	60.45	18100	62480	44380	3.45
Module 5	11.10	56.78	18100	61050	42950	3.37
Module 6	7.08	—	17500	38940	21440	2.23

reported that Imidacloprid 200 SL and Thiamethoxam 25% WG were effective to suppress the whitefly population. *Shrinivas and Shekharappa (2009)* reported that neem seed kernel extract (5%) also reduced the white fly in sorghum. However, a recent report states that Neem oil significantly reduced the incidence of viral and leaf spot disease complexes and increased the yield attributes and yield of black gram (*Trivedi et al. 2014*). *Iqbal et al. (2013)* also found that Imidacloprid was most effective and resulted in a minimum population of whitefly. However, *Khattak et al. (2004)*, also reported that Imidacloprid 17.8 SL was less effective compared to Thiamethoxam 25% WG against whiteflies in green gram.

Among the different treatments, seed yield was numerically highest from module 4 (11.36q/ha), but it was found statistically on par with module 5 (11.10 q/ha) and significantly superior over the rest of the treatments. The seed yield was low from the experimental field with high incidence of YMV which was in accordance with earlier reports. Singh and *Awasthi (2007)* reported that yield attributes in green gram decreased with increased level of YMV incidence. A strong negative correlation was observed between the severity of YMV and total seed yield (*Gupta, 2003*). Similarly, *Singh and Awasthi, 2007*, also reported that yield attributes in black gram decreased with increased level of YMV incidence.

Module 4 (Resistant variety PU-31+ Spray with Azadirachtin, 0.03% after 15 and 30 days of sowing followed by Thiamethoxam 25% WG @ 0.2 g/lt after 45 day of sowing) provided the highest gross returns (Rs. 62480/ha) followed by module 5 (T-5), module 1 (T-1), module 2 (T-2) and module 3 (T-3). The lowest gross returns (Rs. 38940/ha) was computed from conventional farmers' practices. The highest benefit cost ratio (3.45) with highest net return (Rs. 62480) was also obtained from module 4 followed by module 5, module 1, module 2 and module 3. However, benefit cost ratio and net return was found in module 2 is statistically on par with module 3.

CONCLUSION

From the present study, it was clearly evident that the management of YMV should be done through integrated approach, rather than relying upon chemical insecticides alone.

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