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RESEARCH ARTICLE

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Evaluation of Suitable IPM Module for Management of YMV Disease in Mungbean under West Central Table Land Zone of Odisha

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ABSTRACT

Background: YMV disease in mungbean is one of the major disease causing heavy losses annually throughout the country. As the disease is transmitted by insect vector, management of vector is important to check the YMV disease that can minimise the losses. The present investigation was aimed to evaluate different IPM modules for management of YMV disease of mungbean.

Methods: Field experiments were carried out during *Rabi* season of 2016-17 and 2017-18 at the Research Farm of Regional Research and Technology Transfer Station, Chiplima, Sambalpur, Odisha, India. Population of whitefly was recorded on three leaves selected from top, middle and bottom canopy of the plant. Disease severity was recorded by using 0-9 scale.

Result: The IPM module *i.e.* seed treatment with Thiamethoxam 25 WG @ 5 gm kg^{-1} of seed, installation of yellow sticky trap @ 50 ha^{-1} and spraying of Acetamiprid 20 SP @ 0.3 gm l^{-1} of water was found as the most effective among all other modules. Pooled analysis of two years data revealed that 65.5% YMV disease control and 59.3% reduction of white fly population over control were performed by the said IPM module. A maximum increase in yield (84.8%) and highest cost benefit ratio (1.77) were also achieved with the module.

Key words: IPM modules, Mungbean, Whitefly, YMV.

INTRODUCTION

Pulses are one of the important food crops globally due to rich source of protein, carbohydrates, dietary fibre, vitamins, minerals and phytochemicals and they are the second important constituent of Indian diet after cereals. Among the different pulses, mung bean or green gram (*Vigna radiata* L. Wilczek) is a rich source of protein which is one of the essential nutrients of human diet. It contains 55% carbohydrate, 26% protein, 10% moisture and 3% vitamins. It is also capable of fixing atmospheric nitrogen (222 kg ha^{-1}) through symbiotic relationship with Rhizobium in the root nodule of the crop (Rashid *et al*., 2013). During 2017-18, the area under green gram in India was about 41 lakh ha with production of 19 lakh tonnes and productivity of 467 kg ha^{-1}. More than 80 per cent of mungbean production comes from the states of Rajasthan, Madhya Pradesh, Maharashtra, Bihar, Karnataka, TN, Gujarat, Andhra Pradesh, Odisha and Telangana (Annonymus, 2018).

In India, mungbean cultivation is increasing both in terms of total area and production but yield of the crop is low because of many biotic and abiotic constraints. The main cause for the low yield is the susceptibility of the crop to insects, weeds and diseases caused by fungus, virus or bacterium, of which mungbean yellow mosaic virus is one of the most prevalent and destructive biotic stresses in mungbean (Varma and Malathi, 2003). Yellow mosaic disease of mungbean was reported from India in 1955 on mungbean (Nariani, 1960) and whitefly (*Bemisia tabaci*) pest that acts as an efficient vector (Butler, 1977).

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Yield loss depends upon the susceptibility of the variety, time of infection, population of virus transmitter (*Bemisia tabaci*) and other favourable conditions. Yield loss off up to 80% was reported in susceptible cultivars (Ayub *et al*., 1989). It has potential to inflict 100% damage to this crop (Nene *et al*., 1972).

The virus initially develops yellow patches then progressively turns the entire leaf yellow which produces typical yellow mosaic symptoms. The symptoms appear in the form of small irregular yellow specs and spots along the veins, which enlarge until leaves were completely yellowed. Diseased plants are stunted with fewer flowers and pods. The pod contains shrivelled seeds in severe cases and other plant parts also become completely yellow (Sudha *et al.,* 2013).

As the YMV disease of mungbean is transmitted by insect vector so management of vector is important to check the YMV disease. Therefore, it is necessary to develop an IPM module which will minimise the losses caused by YMV disease. For this, the present investigation is carried out to evaluate different IPM modules for management of YMV disease of mungbean.

MATERIALS AND METHODS

The research trial was conducted at the Research Farm of Regional Research and Technology Transfer Station, Chiplima, Sambalpur, Odisha, India. The station is situated at 20°21′N latitude and 80°55′E longitude in Dhankauda block of Sambalpur district at an altitude of 178.8 m above mean sea level. Field experiments were carried out during *Rabi* season of 2016-17 and 2017-18 to study the effect of different IPM modules on YMV disease of mungbean. Eight modules including untreated control were replicated thrice and field trial was laid out in randomized complete block design with a spacing of 25 ×10 cm. Plot sizes were 15 sqm. and Malivia-16 variety was planted during the month of January during both the year. Recommended agronomic practices were applied. Manual weeding and irrigation were carried out when necessary. The modules are M_1 = seed treatment with thiamethoxam 25 WG @ 5 gm kg^{-1} of seed; M_2 = Installation of yellow sticky trap @ 50 ha^{-1}; M_3 = seed treatment with thiamethoxam 25 WG @ 5 gm kg^{-1} of seed and installation of yellow sticky trap @ 50 ha^{-1}; M_4 = seed treatment with thiamethoxam 25 WG @ 5 gm kg^{-1} of seed, installation of yellow sticky trap @ 50 ha^{-1} and spraying of neem oil 0.15% @ 2 ml l^{-1} of water; M_5 = seed treatment with thiamethoxam 25 WG @ 5 gm kg^{-1} of seed, installation of yellow sticky trap @ 50 ha^{-1} and spraying of Acetamiprid 20 SP @ 0.3 gm l^{-1} of water; M_6 = seed treatment with thiamethoxam 25 WG @ 5 gm kg^{-1} of seed, installation of yellow sticky trap @ 50 ha^{-1} and spraying of Triazophos 40 EC @ 2 ml l^{-1} of water; M_7 = seed treatment with thiamethoxam 25 WG @ 5 gm kg^{-1} of seed, installation of yellow sticky trap @ 50 ha^{-1} and spraying of diafenthiuron 50% WP @ 1 gm l^{-1} of water; M_8 = untreated control.

Two insecticidal sprays were given at 15 days interval starting from 25 days after sowing. In each plot one sq m area was fixed from which 5 plants were selected for taking observation excluding the border rows from each plot. Populations of whitefly were recorded on three leaves selected from top, middle and bottom canopy of the plant. The population of the whitefly was recorded on the day before application of the insecticides. The post treatment population of whitefly was recorded at 5, 10, 15 days after each spray.

Reduction over control (ROC) was calculated by using the following formula:

$$\text{ROC\%} = \frac{\text{Population in control plots-Population in treatment plot}}{\text{Population in treatment plot}} \times 100$$

Data collected was transformed to the square root values and analyzed by ANOVA under randomized block design.

Disease severity was recorded before commencement of each spray and final data was recorded 15 days after 2^{nd} spray. To assess the disease scoring for Yellow Mosaic Virus was done on a 0-9 scale (Mayee and Dater, 1986) on the basis of visual observations. The description of scale is given as 0: No plants showing any symptoms, 1= Less than 1% plants exhibiting symptoms, 3=1-10% plants exhibiting symptoms, 5=11-20% plants exhibiting symptoms, 7=21-50% plants exhibiting symptoms,9=50% and more plants exhibiting symptoms

Percent disease index (PDI) was calculated following standard formula given by Mckinny (1923).

$$\text{PDI} = \frac{\text{Sum of all numerical ratings}}{\text{No. of observations} \times \text{Maximum rating}} \times 100$$

The yield of mungbean was recorded from each plot on weight basis and computed to per ha. Cost benefit ratio was calculated in all the modules.

RESULTS AND DISCUSSION

During *Rabi*, 2016-17, least per cent disease severity was observed (Table 1) in M_5 (10.0%) *i.e.* seed treatment with Thiamethoxam 25 WG @ 5 gm kg^{-1} of seed, installation of yellow sticky trap @ 50 ha^{-1} and spraying of Acetamiprid 20 SP @ 0.3 gm l^{-1} of water which was found superior to rest of the modules but significantly at per with M_4, M_6 and M_7. The next best module was M_6 (11.11%) *i.e.* seed treatment with Thiamethoxam 25 WG @ 5 gm kg^{-1} of seed, installation of yellow sticky trap @ 50 ha^{-1} and spraying of Triazophos 40 EC @ 2 ml l^{-1} of water. Significantly maximum percent disease severity was observed in untreated control (32.96%).

During *Rabi*, 2017-18, minimum per cent disease severity was observed (Table 1) in M_5 (19.63%) *i.e.* seed treatment with Thiamethoxam 25 WG @ 5 gm kg^{-1} of seed, installation of yellow sticky trap @ 50 ha^{-1} and spraying of Acetamiprid 20 SP @ 0.3 gm l^{-1} of water followed by M_6 (22.59%) *i.e.* seed treatment with Thiamethoxam 25 WG @ 5 gm kg^{-1} of seed, installation of yellow sticky trap @ 50 ha^{-1} and spraying of Triazophos 40 EC @ 2 ml l^{-1} of water. These two modules were significantly at par also with M_7. Significantly maximum per cent disease severity was observed in untreated control (52.96%).

The pooled data (Table 1) showed that the least percent disease severity was found in M_5 module (14.81%) equivalent to 65.5% reduction in disease severity over control. The next best module was M_6 (16.86%) with 60.8% reduction in disease severity over control. Significantly maximum percent disease severity was observed in untreated control (42.97%). Disease reductions of 58.6%, 51.7%, 44.4%, 41.0% and 27.2% were achieved by the modules M_7, M_4, M_3, M_1 and M_2 respectively.

Application of neem oil in module M_4 *i.e.* seed treatment with Thiamethoxam 25 WG @ 5 gm kg^{-1} of seed, installation of yellow sticky trap @ 50 ha^{-1} and spraying of neem oil

0.15% @ 2 ml l^{-1} of water was also found effective against the disease as compared to control which exhibited a pooled PDI of 20.74% resulting 51.7% disease reduction over untreated control.

The data in the Table 2 revealed that all the insecticide modules were effective in reducing the whitefly population. The results after first and second spray revealed that the highest reduction was observed in the module M_5 containing Acetamiprid 20 SP (59.3% reduction over control) followed by module M_6 containing Triazophos 40 EC (56.2% ROC), module M_7 containing Diafenthiuron 50 WP (54.7% ROC) and module M_4 containing Neem oil 0.15% (44.8% ROC).

Similarly, Acetamiprid (0.3g l^{-1}) was found effective against whitefly in green gram (Singh *et al.,* 2015, Sasmal and Kumar, 2016). Mahalakshmi *et al*. (2018) also reported that Acetamiprid was effective in reducing the incidence of whitefly as well as YMV disease in mungbean. Ghosal *et al*.

Table 1: Effect of different treatment on YMV disease severity in mungbean during *Rabi* 2016-17 and 2017-18.

Module no.	Percent disease index (PDI)			Percent disease control
	2016-17	2017-18	Pooled	
M_1	20.0*(26.47)	30.74(33.55)	25.37(30.15)	41.0
M_2	23.70(29.07)	38.89(38.53)	31.30(33.99)	27.2
M_3	18.89(25.65)	28.89(32.46)	23.89(29.19)	44.4
M_4	14.82(22.54)	26.67(31.04)	20.74(27.08)	51.7
M_5	10.0(18.36)	19.63(26.17)	14.81(22.54)	65.5
M_6	11.11(19.40)	22.59(28.34)	16.86(24.22)	60.8
M_7	12.22(20.30)	23.33(28.78)	17.78(24.85)	58.6
M_8	32.96(35.01)	52.96(46.69)	42.97(40.92)	-
SEm (±)	1.6	1.47	1.07	-
CD (P=0.05)	4.9	4.50	3.29	-

*Figures in parentheses indicate angular transformed values.

Table 2: Effect of different treatment on the population of whitefly in mungbean (pooled data of *Rabi* 2016-17 and 2017-18).

Module no.	Whitefly number $plant^{-1}$				Overall mean	Percent reduction over control
	1 DBS	5 DAS	10 DAS	15 DAS		
M_1	2.07*(1.75)	2.23(1.80)	2.70(1.92)	2.97(1.98)	2.49	36.6
M_2	2.37(1.84)	2.73(1.93)	3.23(2.06)	3.70(2.17)	3.01	23.4
M_3	2.0(1.73)	2.13(1.77)	2.50(1.87)	2.83(1.96)	2.37	39.7
M_4	2.03(1.74)	1.93(1.71)	2.23(1.79)	2.47(1.86)	2.17	44.8
M_5	1.80(1.67)	1.42(1.55)	1.50(1.58)	1.67(1.63)	1.60	59.3
M_6	1.87(1.69)	1.67(1.63)	1.60(1.61)	1.73(1.65)	1.72	56.2
M_7	1.90(1.70)	1.77(1.66)	1.63(1.62)	1.83(1.68)	1.78	54.7
M_8	3.20(2.05)	3.53(2.13)	4.17(2.27)	4.80(2.41)	3.93	-
SEm (±)	0.07	0.07	0.08	0.09	-	-
CD (P=0.05)	0.20	0.21	0.24	0.27	-	-

Note: DBS =Days before spraying, DAS= Days after spraying.

*Figures in parentheses indicate square root transformed values.

Table 3: Effect of different treatment on yield in mungbean during *Rabi* 2016-17 and 2017-18.

Module no.	Yield (kg ha^{-1})			% yield increase over control	B:C ratio
	2016-17	2017-18	Pooled		
M_1	394.3	357.8	376.0	14.3	1.20
M_2	377.6	311.1	344.4	6.9	1.09
M_3	447.0	382.2	414.7	28.7	1.27
M_4	499.8	402.2	451.0	40.0	1.30
M_5	644.2	546.7	595.4	84.8	1.77
M_6	597.0	495.6	546.3	69.6	1.51
M_7	538.7	480.0	509.4	58.1	1.06
M_8	344.3	300.0	322.2	-	-
SEm (±)	27.2	28.64	23.01	-	-
CD (P=0.05)	83.3	87.72	70.46	-	-

(2013) reported that Acetamiprid and Thiamethoxam were most effective in reducing the aphid population in okra.

The pooled yield data over two years (*Rabi*, 2016-17 and 2017-18) revealed that (Table 3) maximum yield was recorded in M_5 module whereas, the lowest yield was recorded in untreated control. The highest benefit cost ratio (1.77) was found from the same module *i.e.* from M_5 module. Mahalakshmi *et al*. (2018) reported that the seed yield of mungbean was numerically highest from the plots treated with Acetamiprid.

CONCLUSION

So, the integrated pest management module which include seed treatment, use of insect trap and safer need based insecticide application in module M_5 *i.e.* seed treatment with Thiamethoxam 25 WG @ 5 gm kg^{-1} of seed, installation of yellow sticky trap @ 50 ha^{-1} and spraying of Acetamiprid 20 SP @ 0.3 gm l^{-1} of water can be adopted for the better management of YMV disease in mungbean in west central table land zone of Odisha.

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