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Evaluation of Integrated Pest Management Against Yellow Mosaic Virus Disease in Blackgram

M. Swathi [a*], K. Lakshmana [a] and K. Tejeswara Rao [a]

[a] ANGRAU, District Agricultural Advisory and Transfer of Technology Centre, Vizianagaram, Andhra Pradesh – 535001, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The evaluation of integrated pest management (IPM) against viral diseases in blackgram was conducted by District Agricultural Advisory and Transfer of Technology Centre (DAATTC), Vizianagaram in five farmer's field during *rabi* seasons of 2019-20 and 2020-21. The results revealed that the disease incidence was lower in IPM module (11.92 %) compared to farmers' practice (27.09 %). An increase in yield of 32.44 % was observed in IPM demonstration (813 kg/ha) compared to farmers' practice (614 kg/ha). The net returns were Rs. 26,339.00 for the IPM module and Rs. 15,810.00 for farmer's practice. The extension gap, technology gap, and technology index were 199 kg/ha, 213 kg/ha, and 20.73 %, respectively. The lower technology index indicates that the technology is feasible for farmers' fields and needs to be popularized to reduce the extension gap and technology gap.

**Corresponding author: Email: mogallapuswathi@gmail.com;*

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Keywords: Yellow mosaic disease; blackgram; whitefly; technology gap; extension gap; technology index.

1. INTRODUCTION

"Blackgram (*Vigna mungo* L. Hepper) is the fourth important short-duration pulse crop Similar to the other pulses, it enriches soil nitrogen content and contains 24 – 26% protein, 60% carbohydrates, 1.5% fat and 3.5 – 4.5% fibre. India is the largest producer and consumer of blackgram in the world. In Andhra Pradesh, it is grown over an area of 4 lakh hectares with production of 4.24 lakh tonnes and productivity of 1059 kg/ha during 2021-22" [1]. The productivity of blackgram in Vizianagaram district was low (595 kg/ha) compared to the state average productivity (1059 kg/ha) due to various biotic and abiotic stresses.

"In India, the quantitative avoidable losses (7-35 %) caused by insect pest complex, both in black gram and green gram vary with different agro-climatic conditions" [2]. "On an average, 2.5 to 3.0 million tonnes of pulses are lost annually due to pest problems" [3].

Blackgram acts as substratum for 64 species of insect pests at various phases of crop growth [4]. Among the insect pests, sucking pests like whitefly, aphids and thrips, leaf webber, pod borers like tobacco caterpillar, spotted pod borer attained the major pest status on the crop [5]. "The yield loss on blackgram due to insect pests at various stages of the crop growth accounts 25 to 70 % in India" [6].

"Among the sucking pests, the whitefly besides causing direct damage to the crop by feeding on cell sap of leaves, it transmits a Geminivirus which causing yellow mosaic virus (YMD) disease. It acts as vector for transmission of *Begomovirus* species *viz*., *Mungbean yellow mosaic india virus* (MYMIV) and *Mungbean yellow mosaic virus* (MYMV on blackgram in India and causes a substantial loss of 30-70 %" [7,8].

"The management of whitefly as insect pest and vector become more complicated now a days. Farmers relay on chemical insecticides for its management but the excessive and indiscriminate use of chemical insecticides not only cause economical restrain on farmers but also imposes harmful effect on the environment as well as human's health. Repeated use of insecticides results in development of resistance in insect pests, adverse effects on non-target organisms, resurgence of secondary insect pests, residues on the food commodities etc". [9]. In view of existing situation and importance of blackgram in Indian economy, the necessary prerequisite is development and popularization of economically sound and environmentally safe integrated management approach for successful management of YMD in blackgram. In keeping all these things in view, the present frontline demonstration (FLD) on "Evaluation of integrated pest management against yellow mosaic virus disease in blackgram" was conducted to study the efficacy of IPM technologies against YMD in blackgram.

2. MATERIALS AND METHODS

The frontline demonstration was conducted in five farmer's field, covering an area of 2 hectares during *rabi* seasons of 2019-20 and 2020-21 in Vizianagaram district of Andhra Pradesh. The treatments in IPM package were seed treatment with imidacloprid 600 FS@5ml/kg seed, removal of infested plants at 15-20 days after sowing (DAS), spraying of acetamiprid 20 SP@0.2g/L at 30 DAS and imidacloprid 17.8 SL@0.3ml/L at 45 DAS for the management of whitefly. The data on incidence of yellow mosaic virus (YMV) and whiteflies was recorded in demonstration and farmers' practice fields from 30 DAS to crop maturity at 15 days interval on 25 randomly selected plants. The per cent disease incidence was calculated with the following formula.

$$\text{Per cent disease incidence} = \frac{\text{(No. of disease infected plants x 100)}}{\text{Total no. of plants}}$$

The yield data was collected in both the IPM and farmers' field. The extension gap, technology gap and technology index were worked out by using the following formula [10,11].

$$\text{Technology gap (kg ha}^{-1}\text{)} = \text{Potential yield (kg ha}^{-1}\text{)} - \text{Demonstration yield (kg ha}^{-1}\text{)}$$

Extension gap (Kg ha^{-1}) = Demonstration yield (Kg ha^{-1}) – Farmer's yield (Kg ha^{-1})

Technology index (%) = (Potential yield (Kgha^{-1})–Demonstration yield (Kgha^{-1})) X100/ Potential yield (Kg ha^{-1})

3. RESULTS AND DISCUSSION

The incidence of whiteflies and YMV were low in IPM plot than farmer's practice during *rabi*, 2019-20 and 2020-21. The mean incidence of whitefly was 2.14 and 3.92 whiteflies/plant and YMV was 11.92 % and 27.09 % in IPM plot and Farmer's practice, respectively (Table 1). The low incidence of whiteflies and YMV in IPM plot was due to the seed treatment with imidacloprid which protected the crop from whiteflies during early crop growth stages, regular monitoring and removal of virus infected plants and spraying of acetamiprid 20 SP@0.2g/L at 30 DAS and imidacloprid 17.8 SL@0.3ml/L at 45 DAS. The results are in line with Archana et al. [12], they found that seed treatment with imidacloprid 600 FS @ 5.0 ml/ kg and two sprays of imidacloprid 17.8 SL @ 0.5 ml/L at 30 and 45 DAS was effective against whiteflies and YMV in blackgram. Similarly, Radhika et al. [13] and Sreenivas et al. [14] reported that seed treatment with imidacloprid recorded the lowest incidence of the sucking pests in blackgram. Duraimurugan and Tyagi [8] noticed that seed treatment with imidacloprid has reduced 40.2 to 81.4 per cent of sucking pests in blackgram.

3.1 Yield and Gap Analysis

The IPM technology had impact on the incidence of YMV and yield of blackgram (Table 2). The increased yield of 32.44 % was recorded in IPM (813 kg/ha) than farmer's practice (614 kg/ha). The net return of Rs. 26,339.00 and Rs. 15,810.00 recorded in IPM and farmer's practice, respectively. The highest benefit cost ratio of 2.33:1 was recorded in the IPM than farmer's practice (1.92:1). The increased yield and net returns in the IPM plot are due to the timely adoption of protection measures against YMV in blackgram. The results are in harmony with the findings of Jahnavi et al. [15]; Archana et al. [12] and Soundarajan and Chitra [16].

The extension gap, technology gap and technology index observed in the present study were 199 kg/ha, 213 kg/ha and 20.73 % respectively, (Table 3). The existed technology gap (213 kg/ha) may be due to the various micro farming situations like variation in soil fertility, weather conditions during crop growth period, crop management practices etc. Therefore, there is an urgent need for development and recommendation of location specific crop management practices to pass over the potential demonstration yield. The results are in line with Biyan et al. [17] and Dhillon [18].

The higher extension gap (199 kg/ha) indicated the lack of awareness on adoption of IPM practices by farmers. Therefore, the efforts are needed to convince the farmers for adoption of IPM over existing conventional practices to get good yield [19].

The technology index of 20.73% showed the feasibility of technology in the farmer's fields of Vizianagaram district of Andhra Pradesh. The findings are in line with Kumari et al. [20]; Kumar et al. [21] and Singh et al. [22].

Table 1. Incidence of whiteflies and yellow mosaic disease on blackgram during *rabi*, 2019-20 and 2020-21

S. No.	Year	No. of whiteflies/plant		Disease incidence (%)	
		IPM	Farmer's practice	IPM	Farmer's practice
1	2019-20	1.95	3.67	9.33	20.67
2	2020-21	2.33	4.16	14.50	33.50
Mean		2.14	3.92	11.92	27.09

Table 2. Effect of IPM of YMV on yield and economics of blackgram

S. No.	Year	Yield (kg/ha)			Gross returns (Rs./ha)		Cost of cultivation (Rs./ha)		Net returns (Rs./ha)		Benefit cost ratio	
		IPM	Farmer's practice	Increase in yield (%)	IPM	Farmer's practice	IPM	Farmer's practice	IPM	Farmer's practice	IPM	Farmer's practice
1	2019-20	883	640	37.97	50331	36480	19386	17658	30945	18822	2.60:1	2.07:1
2	2020-21	742	587	26.41	42294	33459	20562	18952	21732	14507	2.06;1	1.77:1
Mean		813	614	32.44	46313	34970	19974	18305	26339	16665	2.33:1	1.92:1

Table 3. Technology gap, extension gap and technology index of IPM of YMV in blackgram

S. No.	Year	Yield (kg/ha)			Extension gap (kg/ha)	Technology gap (kg/ha)	Technology index (%)
		Potential	IPM	Farmer's practice			
1	2019-20	1025	883	640	243	142	13.85
2	2020-21	1025	742	587	155	283	27.61
Mean		1025	813	614	199	213	20.73

4. CONCLUSION

Yellow Mosaic Virus (YMV) is one of the major biotic stresses to the blackgram, and causing up to 70% yield loss to the crop. There is a gap in potential yield, demonstration yield and farmers' practice due to the existing technological, extension gap and demonstrations had positive effect towards increase in yield of blackgram. The incidence of disease was low in IPM and the increased yield of 32.44 % in IPM than farmer's practice. However, the extension gap and technology gap were more so, there is an urgent need to create awareness among farmers about the implementation of IPM against YMV through the services of extension personnel to improve the blackgram yield and to reduce the extension and technology gaps in the Vizianagaram district of Andhra Pradesh.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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