



Management of yellow mosaic disease in blackgram

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Abstract

Blackgram (*Vigna mungo* L.) is a vital pulse crop valued for its high protein content and role in sustainable agriculture. However, its productivity is severely affected by yellow mosaic disease (YMD), primarily caused by Mungbean yellow mosaic virus (MYMV) and Mungbean yellow mosaic India virus (MYMIV), both transmitted by vector whitefly (*Bemisia tabaci*). To evaluate the efficacy of chemical insecticides in managing YMD through vector control, a field experiment was conducted during the rabi 2024-25 at the Main Agricultural Research Station (MARS), Raichur, India. Among the tested treatments, seed treatment with imidacloprid 600 FS followed by two foliar sprays of flonicamide 50 WG at 0.03 per cent concentration at 20 and 35 days after sowing proved most effective. This combination resulted in the lowest whitefly population (2.6 per plant; 72.02 % reduction over control), minimal disease incidence (30.08 %; 48.99 % reduction over control) and the highest grain yield of 10.2 q/ha (5.43 q/ha improvement over control). The results demonstrate that integrated chemical management significantly reduces YMD impact and enhances black gram productivity under field conditions.

Keywords: Blackgram, mungbean yellow mosaic virus, mungbean yellow mosaic India virus, *Bemisia tabaci*, flonicamide

Introduction

Blackgram (*Vigna mungo* L.) is an essential pulse crop grown widely across India, valued for its rich protein content and its role in promoting sustainable agriculture. Blackgram (*Vigna mungo* (L.) Hepper) is grown as an important Kharif and rabi pulse crop in many South Asian countries like India, Pakistan, Nepal, Bangladesh, Thailand and Korea (Gafoor *et al.*, 2008) [3]. It is cultivated under a wide range of agroecological zones as a subsistence monocrop or intercrop during Kharif, rabi and summer. Blackgram is consumed as dal (whole or split, husked and un-husked) or perched. It is having high amount of lysine, making it an excellent complement to rice providing balanced human nutrition.

The productivity of blackgram is constrained by various biotic stresses, of which yellow mosaic disease (YMD) emerging as a major limiting factor. Several viruses infecting blackgram which include yellow mosaic, leaf curl and leaf crinkle causing significant yield losses (Malathi and John, 2008; Biswas *et al.*, 2012) [2, 8]. Among these, yellow mosaic disease (YMD) is one among the major constraints. YMD is primarily caused

by mungbean yellow mosaic virus (MYMV) and mungbean yellow mosaic India virus (MYMIV), both efficiently transmitted by the vector whitefly (*Bemisia tabaci*), leading to substantial yield losses.

Several methods, primarily focusing on vector management with insecticides, were shown to be fairly effective in reducing yellow mosaic disease in blackgram (Kumar *et al.*, 2006) [7]. With a growing awareness of the risks of chemical usage and its repercussions, botanicals came into a lime light. Antiviral agents have been shown to be abundant in natural compounds derived from plants as they have evolved multiple resistance mechanisms to resist pathogens by producing several secondary metabolites with anti-microbial activities. Moreover, these substances have less negative impact on the environment, as they are readily broken down and have short lasting residual periods. With the increasing worldwide concern on virus diseases, exploitation of novel nature-derived anti-viral agents received increasing attentions. In this context, botanicals were also used in the present investigation for the management of YMD.

Treatment details

Tr. No.	Treatment details
T ₁	Seed treatment with imidacloprid 600 FS at 5ml/kg
T ₂	T ₁ followed by foliar spray with azadirachtin 1500 ppm (0.2 %) at 20 DAS and 35 DAS
T ₃	T ₁ followed by foliar spray with fipronil 5 SC (0.1 %) at 20 DAS and 35 DAS
T ₄	T ₁ followed by foliar spray with flonicamide 50 WG (0.03 %) at 20 DAS and 35 DAS
T ₅	T ₁ followed by foliar spray with dimethoate 30EC (0.20 %) at 20 DAS and 35 DAS
T ₆	T ₁ followed by foliar spray with acephate 95 SG (0.1 %) at 20 DAS and 35 DAS
T ₇	T ₁ followed by foliar spray with difenthiroton 50 WP (0.1 %) at 20 DAS and 35 DAS
T ₈	T ₁ followed by foliar spray with azadirachtin 1500 ppm (0.2 %) at 20 DAS and dimethoate 30 EC (0.2 %) at 35 DAS
T ₉	T ₁ followed by foliar spray with azadirachtin 1500 ppm (0.2%) at 20 DAS and afidopyropen 50 g/L DC (0.2 %) at 35 DAS
T ₁₀	T ₁ followed by foliar spray with azadirachtin 1500 ppm (0.2 %) at 20 DAS and flonicamide 50 WG (0.03 %) at 35 DAS
T ₁₁	T ₁ followed by foliar spray with azadirachtin 1500 ppm at 0.2% at 20 DAS and difenthiroton 50 WP (0.1 %) at 35 DAS
T ₁₂	Control

Material and Methods

To know the effectiveness of different management practices against yellow mosaic virus infecting blackgram, the experiment was conducted at MARS, Raichur, Karnataka (India) during rabi 2024-25 in a randomized block design with 12 treatments including control with three replications by maintaining a spacing of 30 × 10 cm with susceptible variety TAU 1. The trial was laid with different treatments and their combinations in the field under natural epiphytotic conditions. Recommended agronomic practices were followed. Yellow sticky traps were installed in all the treatments except control for the management of whiteflies.

Results & Discussion

During the rabi 2024-25, a field experiment at the Main Agricultural Research Station, Raichur, evaluated with twelve management strategies for controlling yellow mosaic disease (YMD) in blackgram (Plate 1). The study assessed whitefly vector populations, disease incidence, crop yield and economic returns. The untreated control plot (T₁₂) recorded the maximum whitefly population (9.3 per plant) and disease incidence (58.97 %), while treatment seed treatment with imidacloprid 600 FS at 5 ml/kg and two foliar sprays of flonicamide 50 WG at 0.03 % (T₄) have showed the minimum whitefly count (2.6 per plant) and disease incidence (30.08 %) (Table 1, fig.1 and plate 2).

The seed treatment with imidacloprid 600 FS at 5ml/kg followed by foliar spray with flonicamide 50 WG (0.03 %) at 20 DAS and 35 DAS (T₄) produced the maximum yield 10.20 q/ha and benefit-cost (B:C) ratio of 2.16 which is followed by seed treatment with imidacloprid, yellow sticky traps and foliar sprays of azadirachtin and afidopyropen, followed with a yield of 8.58 q/ha and a B:C ratio of 1.77. The control plot yielded only 4.77 q/ha with the minimum B:C ratio of 1.08. These findings highlight T₄ as the most effective and economically viable strategy for managing YMD in blackgram, significantly reducing vector populations and disease impact while enhancing productivity and returns.

These findings are in accordance with Archana *et al.* (2018) [1] who reported that (seed treatment with imidacloprid 600 FS followed by two foliar sprays of imidacloprid 17.8 SL) significantly reduced YMD incidence (13.33 %) and whitefly population (1.86 per plant).

Swathi *et al.* (2024) [11] demonstrated the effectiveness of an integrated pest management (IPM) module in blackgram, which included seed treatment with imidacloprid 600 FS, removal of diseased plants at 15–20 DAS, and foliar sprays of acetamiprid and imidacloprid at 30 and 45 DAS respectively. This approach significantly reduced yellow mosaic disease (YMD) incidence to 11.92 per cent and whitefly population to 2.14 per plant, compared to 27.09 per cent and 3.92 per plant under farmers' practices. The IPM module also boosted yield to 813 kg/ha with a 32.44 per cent increase over conventional methods and achieved a

superior benefit-cost ratio of 2.33:1, underscoring its efficiency in enhancing crop health and profitability.

Rao *et al.* (2021) [9] reported similar results, seed treatment with thiamethoxam (5.0 g/kg) combined with two sprays of acetamiprid (4 %) + fipronil (4 %) (2.0 ml/l) achieved the lowest mean incidence of mungbean yellow mosaic virus (MYMV), recording 3.75 per cent during the Kharif season and 4.84 per cent during the rabi season. This treatment also significantly reduced the whitefly population to 4.14 and 2.95 per plant in the respective seasons. In comparison, seed treatment with imidacloprid 600 FS (5.0 ml/kg) along with two sprays of flonicamide (0.2 ml/l) was also effective but comparatively less efficient in managing MYMV incidence and controlling whitefly populations.

Jain *et al.* (2022) [5] demonstrated comparable outcomes in blackgram by evaluating integrated pest management modules against whitefly (*B. tabaci*) and yellow mosaic virus disease (YMD) during field trials. The most successful module consists of seed treatment with imidacloprid 600 FS (5 ml/kg), installation of yellow sticky traps and a schedule of foliar sprays diafenthiuron 50 WP (0.1 %) at 30 DAS followed by acetamiprid 20 SP (0.5 g/l) at 45 DAS. This integrated approach resulted in a significantly lower YMD incidence of 18.91 per cent, compared to 61.31 per cent in untreated plots. It also effectively curtailed the average whitefly population to 1.10 per plant, markedly lower than the 7.43 recorded in untreated controls. The IDM module delivered the maximum mean seed yield of 10.92q/ha, representing a very good improvement over the untreated yield of 4.85 q/ha yield increase of 125 per cent. Confirming its efficiency in mitigating YMD and maximizing blackgram productivity and profitability.

Flonicamide 50 WG is a systemic insecticide with a unique mode of action that specifically targets the nervous system of insects. It functions as a selective chemical of insect nicotinic acetylcholine receptors (nAChRs), there by disrupting normal neuro transmission (Gordon, 2020) [4], by blocking acetylcholine binding at these receptors, flonicamide effectively suppresses feeding activity. After ingestion, insects typically stop feeding within a few hours, reducing crop damage significantly (Smith and Brown, 2019) [10]. Continued exposure hampers essential physiological processes in insects, ultimately leading to death (Johnson, 2018) [6]. A key advantage of flonicamide is its strong selectivity toward insect receptors, which limits its impact on non-target organisms such as humans, animals and beneficial insects. This selectivity stems from the structural differences between insect and mammalian nAChRs. For this reason, flonicamide 50 WG is widely used in agriculture for the management of pests such as aphids, whiteflies and thrips, due to its effectiveness and low risk to non-target species.

Table 1: Management of yellow mosaic disease in blackgram at Raichur during rabi 2024-25

Tr.no.	Treatment details	No. of Whitefly/ plant	Disease incidence (%)	Yield (q ha ⁻¹)	B:C
T ₁	Seed treatment with imidacloprid 600 FS at 5ml/kg	3.0	31.95 (28.01) *	6.50	1.46
T ₂	T ₁ followed by foliar spray with azadirachtin 1500 ppm (0.2 %) at 20 DAS and 35 DAS	4.3	36.89 (36.05)	8.00	1.72
T ₃	T ₁ followed by foliar spray with fipronil 5 SC (0.1 %) at 20 DAS and 35 DAS	4.6	38.11(38.09)	7.93	1.69
T ₄	T ₁ followed by foliar spray with flonicamide 50 WG (0.03 %) at 20 DAS and 35 DAS	2.6	30.08 (25.14)	10.20	2.16
T ₅	T ₁ followed by foliar spray with dimethoate 30EC (0.20 %) at 20 DAS and 35 DAS	5.3	38.89 (39.42)	7.88	1.65

T ₆	T ₁ followed by foliar spray with acephate 95 SG (0.1 %) at 20 DAS and 35 DAS	4.0	34.96 (32.84)	8.04	1.76
T ₇	T ₁ followed by foliar spray with difenthiuron 50 WP (0.1 %) at 20 DAS and 35 DAS	8.3	50.95 (60.30)	7.54	1.59
T ₈	T ₁ followed by foliar spray with azadirachtin 1500 ppm (0.2 %) at 20 DAS and dimethoate 30 EC (0.2 %) at 35 DAS	6.6	41.61 (44.10)	7.60	1.60
T ₉	T ₁ followed by foliar spray with azadirachtin 1500 ppm (0.2%) at 20 DAS and afidopyropen 50 g/L DC (0.2 %) at 35 DAS	3.3	33.48 (30.44)	8.58	1.77
T ₁₀	T ₁ followed by foliar spray with azadirachtin 1500 ppm (0.2 %) at 20 DAS and flonicamide 50 WG (0.03 %) at 35 DAS	6.0	39.47 (40.42)	7.69	1.64
T ₁₁	T ₁ followed by foliar spray with azadirachtin 1500ppm at 0.2% at 20 DAS and difenthiuron 50 WP (0.1 %) at 35 DAS	7.0	48.52 (56.12)	7.58	1.61
T ₁₂	Untreated control	9.3	58.97 (73.31)	4.77	1.08
	S. Em±	0.30	2.35	0.45	
	C. D. at 5 %	0.90	6.89	1.32	
	C. V.	9.95	10.09	-	

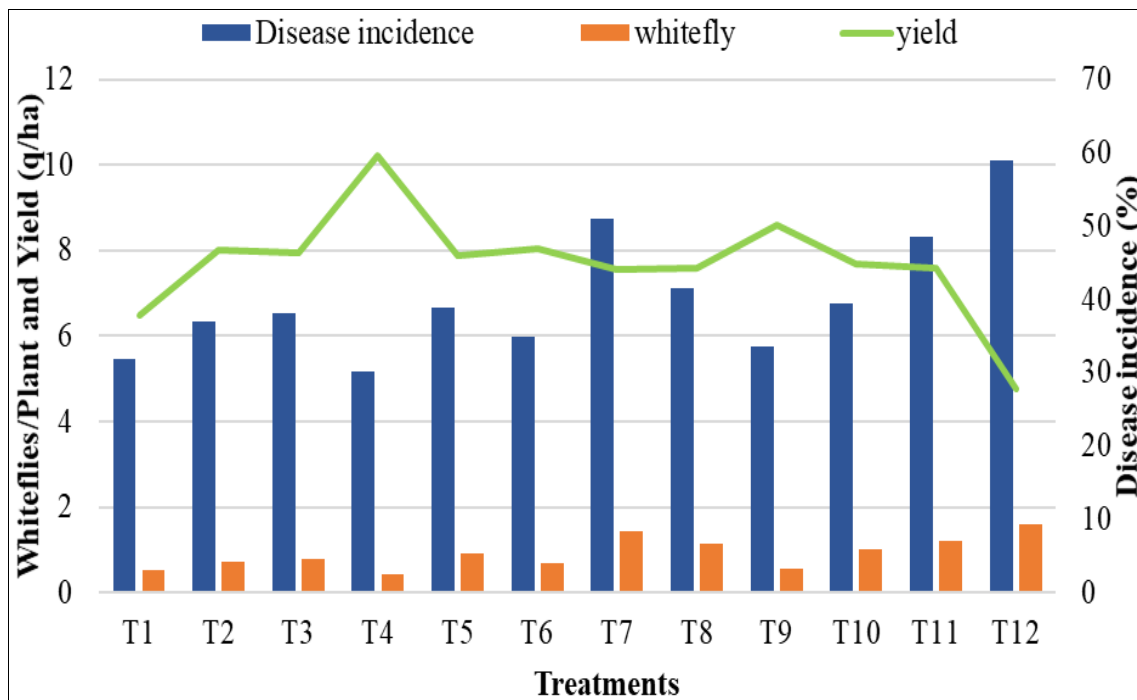


Fig 1: Effect of different treatments on whitefly population, disease incidence and YMD incidence in blackgram during rabi, 2024-25 at MARS, Raichur



Plate 1: Field view of yellow mosaic disease management experimental plot



Seed treatment with imidacloprid 600 FS at 5 ml/kg seed followed by foliar spray with flonicamide 50 WG (0.03 %) at 20 and 35 DAS (T₄)



Seed treatment with imidacloprid 600 FS at 5 ml/kg seed followed by foliar spray with azadirachtin 1500 ppm (0.2 %) at 20 DAS and afidopyropen 50 g/l DC (0.2 %) at 35 DAS (T₉)



Plate 2: Management of yellow mosaic disease in blackgram

Untreated control (T₁₂)

Conclusion

Among the different management strategies tested for YMV in blackgram, the most effective treatment was seed treatment with imidacloprid 600 FS at 5 ml/kg, followed by yellow sticky traps and a foliar spray of flonicamide 50 WG at 0.03 per cent at 20 and 35 DAS. This combination resulted in the significantly minimum disease incidence (30.08 %), the minimum mean whitefly population (2.6 whiteflies/plant) and the maximum yield (10.2 q/ha) as well as maximum cost benefit ratio.

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