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Demonstration of yellow mosaic virus resistant varieties of black gram in Prakasam district of Andhra Pradesh

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Abstract
Yellow Mosaic Virus is the major problem in pulses in prakasam district which leads to major yield reduction. A new variety of black gram tolerant to yellow mosaic virus was introduced and demonstrated in the Prakasam district. Krishi Vigyan Kendra, Darsi, assessed the performance of yellow mosaic virus resistant variety TBG 104 over yellow mosaic virus susceptible variety LBG 752 in cluster Front Line Demonstrations s in 25 acres each from 2016-17 to 2018-19. TBG 104 have shown advantage over LBG 752 in terms of yield and C: B ratio. Average yield of TBG 104 was 11.9 q ha^{-1} with C: B ratio of 1:1.7. Whereas, LBG 752 recorded yield of 11.0 q ha^{-1} with C: B ratio of 1:1.4.

Keywords: Black gram, yellow mosaic virus, yield, economics

Introduction
Black gram, *Vigna mungo* (L.) Hepper, is the fourth important short duration pulse crop grown in India due to its nutritional value, as it contains high level of protein (25g/100g). In India, black gram production and consumption is highest in the world. In Andhra Pradesh, during 2017-18 black gram was grown in an area of 5 lakh ha with production of 3.29 lakh tonnes and productivity of 657 kg/ha (Indiastat.com) [2]. In prakasam district during 2017-18 black gram was grown in an area of 20.1 th.ha with production of 7.3 th.t and productivity of 362.2 kg/ha. Low productivity of black gram (0.425 ton ha^{-1}) in India can be attributed to biotic stresses including viruses which causes yellow mosaic virus. Yellow Mosaic Virus is a major disease observed in pulses during recent years. Yellow mosaic virus is the most destructive disease during all seasons. It results in heavy crop loss from 50 to 70 per cent, especially if the disease occurs in the early stages of crop growth. Black gram is subjected to attack by as many as 64 species of insect pests (Lal, 1987) [4]. Plant viral diseases cause serious economic losses in many pulse crops by reducing seed yield and quality (Schreinemaher *et al.*, 2015) [5]. Plant viral diseases cause serious economic losses in many pulse crops by reducing seed yield and quality. Among the various viral diseases, the yellow mosaic disease caused by Mungbean yellow mosaic virus (MYMV) is the most serious disease and major bottle neck for the production of blackgram. This disease is popularly known as "Yellow plague of kharif pulses" [1]. As the disease spread through vectors and this virus survives in the weed host and other legume crops there was increase in cost of cultivation towards the plant protection chemicals. To manage this, generally farmers use huge amount of pesticides indiscriminately without any proper diagnosis which results into development of resistance and resurgence of the pests as well as environment pollution. The potential solution is to identify the tolerant varieties of yellow mosaic virus. Therefore there is a need to introduce yellow mosaic virus resistant varieties in black gram. In order to overcome these problems YMV resistant variety of black gram was introduced in prakasam district under cluster front line demonstrations.

Materials and Methods
The present demonstration on Yellow mosaic virus resistant varieties was conducted during *Kharif* season at polavaram, mundlamuru mandal during 2016-17, veligandla, veligandla mandal during 2017-18, gavinivaripalem, chirala mandal during 2018-19. In this demonstration 25 farmers were selected during each year under cluster front line demonstration and demonstration was conducted in 10 ha during each year.

Integrated crop management was imposed with improved variety.

Treatments

Improved technology

- Yellow mosaic virus tolerant variety TBG 104
- Seed treatment with rhizobium @ 10 ml/kg
- Seed treatment with carbendazim 50% WP @ 2.5 g/kg
- Erection of yellow sticky traps @ 10
- Spraying of azadirachtin 300 ppm @ 1.0 l/ac as protective spray
- Spraying of acetamaprid 20% FS @ 40 g/ac based on ETL for whiteflies
- Spraying of emamectin benzoate @ 80 g/ac based on ETL for maruca pod borer.

Farmers followed the practice of sowing yellow mosaic virus susceptible variety LBG 752, using excess dose application of N fertilizers and indiscriminate spraying of different Insecticide mixtures like imidacloprid, triazophos, diafenthuiron, fipronil, acephate, profenophos at different crop stages.

Observations

Plot wise data was recorded in ICM plot and farmers practice. The percentage of disease incidence was calculated on the basis of total number of healthy plants and infested ones. Information of yield and economic evaluation in terms of net profit earned and cost benefit ratio was recorded. Average rainfall received during demonstration was 94.0 mm (2016-17), 90.7 mm (2017-18) and 51.9 mm (2018-19).

Economics was calculated as shown below:

Cost of cultivation (Rs. **ha^{-1}):** Cost of cultivation (₹ ha^{-1}) was calculated considering the prevailing charges of agricultural operations and market price of inputs involved.

Gross returns (Rs. **ha^{-1}):** Gross returns were obtained by converting the harvest into monetary terms at the prevailing market rate during the course of studies.

Gross return (₹ ha^{-1}) = (Seed yield x price)

Net returns (Rs.ha^{-1}): Net returns were obtained by deducting cost of cultivation from gross return.

Net returns (₹ ha^{-1}) = Gross return (₹ ha^{-1}) - Cost of cultivation (₹ ha^{-1})

Cost: benefit ratio: The cost: benefit ratio was calculated by dividing gross returns by cost of cultivation.

$$\text{Cost: benefit ratio} = \frac{\text{Gross returns (₹ ha}^{-1}\text{)}}{\text{cost of cultivation (₹ ha}^{-1}\text{)}}$$

Table 1: Salient features of varieties of black gram

Variety	Duration (days)	Yield (q ha^{-1})	Characteristics
LBG 752	75-80	15-17.5	Moderately tolerant to yellow mosaic virus. Polished variety. Suitable for late sowings after rice.
TBG 104	70-75	20-22.5	Tolerant to yellow mosaic virus. Suitable for all seasons.

Results and Discussion

During the period wise report, no incidence of YMV was observed during 2016-17, 2017-18 and incidence of YMV was observed during 2018-19. Per cent YMV incidence was presented in the Table 2. Per cent incidence of YMV in TBG 104 was 0, 0 and 5.25 with mean of 1.75 and 27, 25 and 15.7 with mean of 22.5 in farmers variety during 2016-17, 2017-18 and 2018-19, respectively (Table 2). Archana *et al.*, 2018 [1] reported that seed treatment with imidacloprid 600 FS @ 5.0 ml/ kg and 2 sprays of imidacloprid 17.8 SL (@ 0.5 ml/l, 30 and 45 DAS had significantly less YMV incidence (13.33%) and whitefly population (1.86/ plant). Similarly, seed treatment and spraying with imidacloprid at different intervals during crop growth was found effective in reducing the incidence of YMD and its vector (Jayappa *et al.*, 2017) [3].

Table 2: Per cent disease incidence in black gram

Year	Demo	Farmer practice
	Per cent of YMV incidence	Per cent of YMV incidence
2016-17	0	27
2017-18	0	25
2018-19	5.25	15.7
Mean	1.75	22.5

TBG 104

LBG 752

Yield

Perusal of the data presented in the Table 3 revealed that under demo plot, yield was found to be significantly higher than under control (farmers practice) during all the years (2016-17 to 2018-19). TBG 104 recorded yield of 16.3, 11.0 and 8.5 during 2016-17, 2017-18 and 2018-19, respectively with mean of 11.9 q ha^{-1}. Whereas, LBG 752 recorded yield of 12.4, 4.8 and 6.3 during 2016-17, 2017-18 and 2018-19, respectively with mean of 11.0 q ha^{-1}. Per cent increase in yield under demo plot over check plot was 7.8. The higher yield resulted due to lower incidence of yellow mosaic virus. Negative correlation was observed between per cent YMV incidence and yield in demo plot (Table 4). Whereas, positive correlation was observed between YMV incidence and yield in check plot (Table 5). Archana *et al*, 2018 reported that seed treatment with imidacloprid 600 FS and two sprays of imidacloprid 17.8 SL) observed higher growth and seed yield

Economics

Perusal of the data presented in the Table 3 revealed that gross returns, net returns and C: B ratio were substantially higher in demo plot (TBG 104) compared to farmers practice-check variety (LBG 752). Mean gross returns of TBG 104 were 46317 Rs ha^{-1}. Whereas, in check plot, mean gross returns were 40850Rs ha^{-1}. Net returns of TBG 104 were 18150, 23250 and14000 during 2016-17, 2017-18 and 2018-19, respectively with mean of 18467 Rs ha^{-1}. C: B ratio of TBG 104 was 1:1.7, 1:1.8 and 1:1.5 during 2016-17, 2017-18 and 2018-19, respectively with mean of 1:1.7. Net returns in control plot were 7900, 18600 and 11300 during 2016-17, 2017-18 and 2018-19, respectively with mean of 12600 Rs ha^{-1} and C: B ratio was 1:1.3, 1:1.6 and 1:1.4 during 2016-17, 2017-18 and 2018-19, respectively with mean of 1:1.4. Higher net returns and C: B ratio in TBG 104 was due to higher grain yields.

Table 3: Yield and economics of improved variety of black gram TBG 104 and check variety LBG 752

Year	Yield (q ha^{-1})		Per cent increase in yield over check	Cost of cultivation (Rs ha^{-1})		Gross returns (Rs ha^{-1})		Net returns (Rs ha^{-1})		C: B ratio	
	Demo	Check		Demo	Check	Demo	Check	Demo	Check	Demo	Check
2016-17	16.3	14.5	12.4	26550	27400	44700	35300	18150	7900	1:1.7	1:1.3
2017-18	11.0	10.5	4.8	28500	28650	51750	47250	23250	18600	1:1.8	1:1.6
2018-19	8.5	8.0	6.3	28500	28700	42500	40000	14000	11300	1:1.5	1:1.4
Mean	11.9	11.0	7.8	27850	28250	46317	40850	18467	12600	1:1.7	1:1.4

Table 4: Correlation between YMV incidence and yield of TBG 104 (demo)

	Per cent YMV incidence	Yield (q/ha)
Per cent YMV incidence	1	
Yield (q/ha)	-0.75	1

Table 5: Correlation between YMV incidence and yield of LBG 752 (check)

	Per cent YMV incidence	Yield (q/ha)
Per cent YMV incidence	1	
Yield (q/ha)	0.88	1

Conclusion

Yellow Mosaic Virus resistant variety of black gram performed well in Prakasam district and gave higher yields and net returns over check variety.

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