

Original Research Article

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Efficacy of Integrated Management of Web Blight of Mungbean in Kymore Plateu and Satpura Hills Agroclimatic Zone of Madhya Pradesh, India

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ABSTRACT

In order to assess the efficacy of four different integrated management modules including farmers practice for web blight disease of green gram, a three year on farm trials were conducted on 46 farmer's fields of Sarethi, Chhavari, Mankesher and Barmani Villages in Sidhi District of Madhya Pradesh during 2016-2019. The average web blight incidence ranged from 15.6 to 51.25 % in different surveyed mungbean producing areas. The experimental findings revealed that all three management modules were found superior over farmers practice. The modules T₄ having seed treatment with Carboxin @ 2 g/kg seed + Seed inoculation of *Rhizobium* @ 20 g/ kg Seed + Soil treatment with *Trichoderma viridi* @ 5 kg incubated in 50 kg vermicompost for 72 hrs. + Foliar spray of 10 % kranj leaf extract at 30 DAS and Propiconazole-25SC @ 0.1% at 45 DAS at early onset of disease was found most effective in reducing and web blight disease incidence (80.08%) and increasing the yield (44.32%) and benefit cost ratio (1.69). This was followed by Seed treatment with Carboxin @ 2 g + Seed inoculation of *Trichoderma viridi* @ 5 g/kg seed + *Rhizobium* and PSB @ 20 g/kg seed + foliar spray of 10% Kranj leaf extract at 30 DAS. It can be concluded that module T₄ may be considered for improved sustainable management of web blight in mungbean.

Keywords

Mungbean, Integrated disease management, Web blight, disease incidence

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Introduction

Mungbean (*Vigna radiata* (L.) Wilczek) commonly known as green gram or golden gram is an important pulse crop. Mungbean seeds are rich in proteins (~24% easily digestible protein), fiber, antioxidants, and phytonutrients (Itoh *et al.*, 2006). Mungbean

is consumed as whole seed or split cooking, flour, or as sprouts, thus, forms an important source of dietary protein. Mungbean sprouts contain high amounts of thiamine, niacin, and ascorbic acid. India is the largest producer of mungbean, however, it is cultivated throughout Asia including Pakistan, Bangladesh, Sri Lanka, Thailand, Cambodia,

Vietnam, Indonesia, Malaysia, South China, Africa, Australia, United State of America and West Indies. In India it is grown in almost all parts of the country during summer and rainy season. Mungbean is the third most important pulse crop of India covering an area of approximately 4.305 million hectares and production of 2.07 million tons of grain with productivity of 481 kg/ha (Anonymous, 2017). Yield potential of mungbean is in the range of 2.5–3.0 t/ha, however, the average productivity of mungbean is staggering low due to several abiotic and biotic constraints, poor crop management practices and non-availability of quality seeds of improved varieties to farmers (Chauhan *et al.*, 2010; Pratap *et al.*, 2019).

Among the biotic factors, Web blight is not only one of the major constraints in the production of mungbean alone but for many other pulses in warm humid tropic zones of the world also. In Mungbean, Rhizoctonia blight was firstly reported from Philippines in 1924 (Nacien, *et al.*, 1924). In India, first report of Web blight occurrence in mungbean was given by Dwivedi and Saksena in 1974 from Kanpur, Uttar Pradesh and subsequently it has been reported from Assam (Saikia, 1976), Punjab (Bains *et al.*, 1988), Madhya Pradesh (Tiwari and Khare, 1998), Bihar, Rajasthan, Haryana and Himanchal Pradesh (Anonymous, 2014).

In 1976 Saikia gave an account of the incidence and etiology of blight of *Phaseolus aureus* (*Vigna radiata*) resulting into 17-90 per cent incidence. The disease has been observed to reduce 33 to 40 per cent grain yield and 28.6 per cent in 1000 grain weight at different level of disease severity and in different variety of mungbean (Gupta *et al.*, 2010 and Singh *et al.*, 2012). Since then, the web blight of mungbean has become one of the most serious problems of this crop in Northern India causing extensive damage to mungbean. In order to reduce the web blight

severity in Mungbean, a number of fungicides have been tried and among them Propiconazole (Akhtar *et al.*, 2014) and Carbendazim (Jhamaria and Sharma, 2002) have been found highly effective in controlling the disease.

Presently, farmers are extensively using several fungicides either singly or in combination to protect crop from any type of damage caused by Web blight disease, however, they have been failed to minimize the losses. The often indiscriminate use of huge amount of fungicides has resulted in phyto-toxicity, destruction of earthworms, and other health hazards. An attempt was, therefore, made to evaluate integrated web blight management modules as a rational approach to develop effective and eco-friendly Integrated Disease Management Modules (IDMs) for sustainable production of mungbean.

Materials and Methods

Field Survey

During the year 2015-16, surveys were conducted for the presence of web blight disease of mungbean in 16 different villages viz., Upani, Sonversha, Bhaisarha, Jhalwar, Chorgarhi, Chauwahi, Tikari, Tamsar, Tenduha no.-1, Barhai, Sarethi, Gopalpur, Madhuri, Gajaraha, Mamder and Mata with varying latitudes and longitudes (Table 2) in five different field were chosen from each villages of four different blocks of Sidhi District in Madhya Pradesh during the months of July- August In the each visited field three plot of size 1x1 meter were selected to observe overall disease incidence on visual symptoms. Data were recorded on disease incidence (%) by counting total number of plant as well as diseased plant. Per cent disease incidence was calculated by following formula given by (Nene, 1972).

Disease Incidence (%) = (No. of diseased plants / Total no. of assessed plants) x 100

Integrated disease management

A field experiment was conducted during Kharif season of 2016-17, 2017-18 and 2018-19 at 46 farmer's fields of Sarethi, Bermani, Chhavari and Mankesher villages of Sidhi district by Krishi Vigyan Kendra, Sidhi (MP) to find out efficacy of different integrated disease management modules against web blight disease of mungbean under the On Farm Trial (OFT) activity of KVK. The trials were laid out in Randomized block design having four treatments including control (farmers practice) maintaining 5 replications (Table 1). The experimental field was prepared by ploughing thrice with cultivator followed by planking for fine tilt and smooth surface.

Recommended dose of FYM (1 t/ha) was mixed in soil 30 days before sowing and recommended dose of fertilizers (20:40:20 kg NPK/ha) was applied at the time of sowing. The seed variety HUM-12 was grown at 45 x 15 cm spacing. Standard agronomical practices were followed to grow the crop. Incidence of the disease was recorded seven days after imposing the treatment by taking counts of twenty randomly selected and tagged plants leaving the borders. Percent disease incidence and reduction in disease incidence were calculated by following formulae as given above by Nene (1972).

Reduction in disease incidence (%)
= {(Disease incidence in untreated plots - disease incidence in treated plot) / Disease incidence in untreated plots} x 100

Estimation of Benefit-Cost Ratio

Grain yield of each plot was taken from

whole population separately and yield of each module was calculated by cumulating the successive plucking from respective field and computing to kilogram per hectare. The data were tabulated, pooled and ranked on the basis of their yield performance. The benefit-cost ratio (BCR) of different modules was calculated by estimating different cost of cultivation and return from yield after converting them to one hectare land. Average market price of mungbean was rupees 52.0 per kg during experimental period. Benefit-cost ratio was calculated by using following formula:

BCR = Grass income/ total cost of cultivation

The field data was analyzed in Randomized Block design by F test for significance and critical difference of values were calculated at 5 per cent probability level.

Results and Discussion

Field survey

In total 16 locations were surveyed from 05 blocks of Madhya Pradesh. It was observed that surveyed areas were predominately occupied with four Mungbean varieties namely HUM-1, HUM-6, Pusa Vishal K-851 and TM-37. The average web blight incidence ranged from 15.6 to 51.25 % in different surveyed areas of mungbean production. However, the disease incidence significantly varied not only at different locations but also among different varieties used by respective farmer. Maximum average incidence of web blight of mungbean was recorded in different locations of Sidhi block. Among different locations of Sidhi, highest average incidence of 51.25 % was recorded in Upani location. Different locations of Rampur Naikin block showed lesser incidence in surveyed area and minimum incidence of 15.6 % was recorded for web blight of mungbean from Mamder

location. Among the four varieties, it was observed that K-851 was showing more average incidence of web blight in comparison to TM-37 in different locations of Raipur Naikin. Detailed data for 16 different locations of five blocks of Madhya Pradesh for incidence of web blight of mungbean has been presented in table 2 along with GPS locations of surveyed fields.

The variation in the web blight incidence in year at different place could be attributed to seed and soil born nature of *R. solani*. Singh *et al.*, 2003 reported that web blight incidence varied from 1.0 to 69 percent with an average of 12.7 in Eastern Uttar Pradesh. In another study by Saikia, 1976 a high disease incidence (85-90%) coupled with 25-30% plant mortality had been observed earlier due to *R. solani*.

Integrated disease management

The impact of four different IDM modules on the severity of web blight disease in mungbean was recorded. The web blight disease incidence varied from 8.80 to 51.5 per cent depending on IDMs during different years. During all the three years minimum disease incidence was recorded in treatment T₄ (Seed treatment with Carboxin @ 2 g/kg seed + Seed inoculation of *Rhizobium* @ 20 g/kg Seed + Soil treatment with *Trichoderma viridi* @ 5 kg incubated in 50 kg vermicompost for 72 hrs. + Foliar spray of 10 % Kranj leaf extract at 30 DAS and Propiconazole-25SC @ 0.1% at 45 DAS). Lowest average web blight disease incidence of 9.33% was recorded in the treatment T₄. This was followed by treatment T₃ (Seed treatment with Carboxin @ 2 g + Seed inoculation of *Trichoderma viridi* @ 5 g/kg seed + *Rhizobium* and PSB @ 20 g/kg seed + foliar spray of 10% Kranj leaf extract at 30 DAS) where 16.39 % disease incidence was

recorded. Reduction in disease incidence over check (T₁) was calculated and it was observed that treatment T₄ maximum inhibited the disease and 80.08 % disease control was recorded over control. The highest disease incidence for all the three years was recorded in T₁ (Control) with average disease incidence of 46.84 %. The detailed data for disease incidence during different years in all the four treatments are given in table 3.

Further yield and number of pods per plant was recorded in different treatments and it was observed that maximum yield and number of pods per plant were recorded in treatment T₄ during all the three years. The maximum average yield and average number of pods per plant of respectively 579.33 kg/ha and 22.13 was recorded in the treatment T₄. This was followed by treatment T₃ where respectively 501.03 kg/ha and 19.73 average yield and average number of pods per plant were recorded. However, minimum average yield and average number of pods per plant of respectively 401.42 kg/ha and 15.2 was recorded in the treatment T₁. Treatment T₄ was having respectively 44.32 % and 45.59 % increase in yield and pods per plant over control T₁. The detailed data for all the IDM modules for yield and pods per plant in mungbean are given in table 4.

Use of different bio-control agents especially *Trichoderma* is a pragmatic approach for plant disease management in various crops and also can be utilized in other purposes like biofertilizers, in bio-remediation, plant growth promoting agents etc. (Kumar *et al.*, 2009; Srivastava *et al.*, 2009; Kumar *et al.*, 2014; Kumar *et al.*, 2015 and Jain *et al.*, 2016). Seed treatment and soil application of *T. viride* effectively reduced growth of *R. solani* and also promoted plant growth in urd and mungbean (Dubey and Patel, 2002; Dubey *et al.*, 2011).

Table.1 Details of different Integrated Disease Management Modules (IDMs) in mungbean

Treatment	Details
T ₁	Control
T ₂	Seed treatment with Carboxin @ 2 g + Seed inoculation with <i>Trichoderma viridi</i> @ 5 g/kg seed
T ₃	Seed treatment with Carboxin @ 2 g + Seed inoculation of <i>Trichoderma viridi</i> @ 5 g/kg seed + <i>Rhizobium</i> and PSB @ 20 g/kg seed + foliar spray of 10% Kranj leaf extract at 30 DAS
T ₄	Seed treatment with Carboxin @ 2 g/kg seed + Seed inoculation of <i>Rhizobium</i> @ 20 g/ kg Seed + Soil treatment with <i>Trichoderma viridi</i> @ 5 kg incubated in 50 kg vermicompost for 72 hrs. + Foliar spray of 10 % kranj leaf extract at 30 DAS and Propiconazole-25SC @ 0.1% at 45 DAS

Table.2 Incidence of Web blight of mungbean in different blocks of Sidhi district (Madhya Pradesh)

Locations	Block	Variety	GPS Location		Disease Incidence (%)	
			Latitude	Longitude	Range	Average
Upani	Sidhi	K-851	24 ⁰ 22' 58.6"	81 ⁰ 56'25.9"	21-69	51.25
Sonversha	Sidhi	HUM-6	24 ⁰ 23' 57.5"	81 ⁰ 47'36.0"	26-52	42.60
Bhaisharha	Rampur Naikin	K-851	24 ⁰ 17' 23.0"	81 ⁰ 21'46.2"	21-43	39.40
Jhalwar	Rampur Naikin	TM-37	24 ⁰ 23' 34.9"	81 ⁰ 34'19.9"	08-29	18.00
Chorgahi	Rampur Naikin	PusaVishal	24 ⁰ 18' 52.9"	81 ⁰ 24'40.2"	18-34	24.50
Chuwahi	Majhauri	K-851	24 ⁰ 08' 29.5"	81 ⁰ 36'6.28"	12-46	39.00
Tikari	Majhauri	HUM-1	24 ⁰ 10' 6.3"	81 ⁰ 51'35.8"	00-49	35.00
Tamsar	Kushmi	TM-37	24 ⁰ 12' 1.3"	81 ⁰ 50'49.5"	13-42	37.50
Tenduha No.-	Sihawal	K-851	24 ⁰ 24' 51.2"	81 ⁰ 01'44.8"	11-55	41.70
Barhai	Sidhi	HUM-1	24 ⁰ 12' 46.2"	81 ⁰ 45'48.20"	05-58	49.00
Sarethi	Sidhi	HUM-1	24 ⁰ 15'17.7"	81 ⁰ 44' 8.3"	02-39	31.50
Gopalpur	Rampur Naikin	K-851	24 ⁰ 17'10.8"	81 ⁰ 20' 51.6"	07-42	34.25
Madhuri	Sidhi	HUM-1	24 ⁰ 17' 23.0"	81 ⁰ 21' 28.2"	04-42	31.00
Gajaraha	Sidhi	K-851	24 ⁰ 24'25.9"	81 ⁰ 01' 13.5"	02-28	20.50
Mamder	Rampur Naikin	TM-37	24 ⁰ 24'48.9"	81 ⁰ 33'36.1"	03-25	15.60
Mata	Sidhi	HUM-1	24 ⁰ 15' 02.9"	81 ⁰ 41' 9.6"	09-56	47.50

Dubey 2003, proved that seed treatment with *Trichoderma viride* + Vitavax + *Rhizobium* is very effective for management of web blight pathogen of mungbean. Tiwari *et al.*, 2002 and Kumar *et al.*, 2017 reported that propiconazole and carbendazim are individually effective against the *R. solani* by maximum inhibiting the mycelial growth and sclerotia formation. Akhtar *et al.*, 2014 found that 0.1 per cent foliar spray of propiconazole at early onset of disease provided 78 per cent reduction in web blight incidence and increases 21.7 per cent in yield over control. Foliar spray of *Pongamia glabra* leaf extract successfully reduce web

blight of urd and mungbean and can be further exploited in organic farming (Dubey, 2002). Sharma and Tripathi, 2001 observed that seed treatment and two foliar sprays of tilt (0.1%) at 15 days interval was most effective in reducing disease severity (30-32%) and increased grain yield (950-1012 kg/ha) as well as 1000-grain weight followed by bavistin, caftaf and indofil M-45 sprayed plots. Sharma and Tripathi, 2001 reported that propiconazole (0.1%) at 15 days interval resulted highest reduction in disease severity (30-32%), increases grain yield (950-1012 kg/ha) and 1000-grain weight (35 g).

Table.3 Effect of IDM modules on web blight incidence in mungbean

Treatment	Disease incidence (%)				Reduction in disease incidence over check (T ₁)			
	2016-17	2017-18	2018-19	Average	2016-17	2017-18	2018-19	Average
T ₁	51.50	48.06	40.96	46.84	0.00	0.00	0.00	0.00
T ₂	32.83	35.40	32.74	33.66	36.25	26.34	20.07	28.14
T ₃	14.66	15.60	18.90	16.39	71.53	67.54	53.86	65.01
T ₄	8.80	9.50	9.70	9.33	82.91	80.23	76.32	80.08
S Em±	1.83	1.97	2.35	-	-	-	-	-
CD at 5%	5.72	6.24	7.32	-	-	-	-	-

Economics of IDM

The economics was also calculated after the experimentation based on the expenditure incurred for different IDMs imposed and the income from the yield of mungbean. All the three tested modules were found significantly superior over the control T₁ and more return was recorded in tested IDM modules. However, it was observed that maximum average net profit of Rs.12288.25/- per ha was

obtained from treatment T₄ followed by T₃ (Rs. 9016.32/- per ha) which is significantly higher than the usual practice done by the farmers of the area.

The maximum benefit cost ratio of 1.69 was recorded in treatment T₄ followed by T₃ where 1.52 B:C was recorded. The minimum B:C of 1.25 was recorded in control T₁. The data for economics of different IDM modules are presented in table 5.

Table.4 Effect of integrated Web Blight management modules on yield and pods per plant in mungbean

Treatment	Yield(kg/ha)				Per cent increase in yield over check (T ₁)				Number of pod/ plant				Per cent increase in no. of pod/ plant over check (T ₁)			
	2016-17	2017-18	2018-19	Average	2016-17	2017-18	2018-19	Average	2016-17	2017-18	2018-19	Average	2016-17	2017-18	2018-19	Average
T₁	404.00	394.25	406.00	401.42	0.00	0.00	0.00	0.00	15.20	15.00	15.40	15.20	0.00	0.00	0.00	0.00
T₂	423.75	412.50	421.50	419.25	4.89	4.63	3.82	4.44	17.00	16.80	16.20	16.67	11.84	12.00	5.20	9.67
T₃	507.50	490.50	505.10	501.03	25.61	24.41	24.40	24.82	19.80	19.20	20.20	19.73	30.26	28.00	31.17	29.80
T₄	569.50	580.50	588.00	579.33	40.96	47.24	44.82	44.32	22.00	22.00	22.40	22.13	44.74	46.67	45.46	45.59
S Em±	22.42	23.99	22.58	-	-	-	-	-	0.96	0.66	0.59	-	-	-	-	-
CD at 5%	69.87	74.76	71.23	-	-	-	-	-	3.10	2.13	1.92	-	-	-	-	-

Table.5 Economic of different IDM modules of web blight management practices in mungbean

Treat ment	Cost of Cultivation(Rs./ha)				Grass income (Rs./ha)				Net income (Rs./ha)				B: C ratio			
	2016-17	2017-18	2018-19	Average	2016-17	2017-18	2018-19	Average	2016-17	2017-18	2018-19	Average	2016-17	2017-18	2018-19	Average
T₁	16137.25	16212.50	16230.25	16193.33	19448.00	20501.00	21112.00	20353.67	3310.75	4288.50	4881.25	4160.17	1.20	1.26	1.30	1.25
T₂	16205.00	16345.50	16412.25	16320.92	26364.00	21450.00	21918.00	23244.00	5830.00	5104.50	5505.95	5480.15	1.35	1.31	1.33	1.33
T₃	16895.75	16990.00	17096.50	16994.08	26260.00	25506.00	26265.20	26010.40	9364.25	8516.00	9168.70	9016.32	1.54	1.50	1.53	1.52
T₄	17720.75	17842.00	17948.50	17837.08	29614.00	30186.00	30576.00	30125.33	11893.25	12344.00	12627.50	12288.25	1.67	1.69	1.70	1.69

The present study incorporating chemical, bio-control agent, with compost and phyto-extract use in an integrated manner can be successfully utilized not only in web blight management but also in increased yield and benefit cost ratio in mungbean.

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