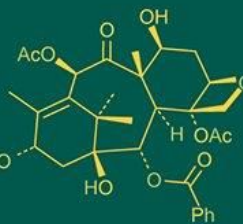
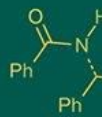


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2025): 5.29
IJABR 2025; SP-9(12): 1652-1655
www.biochemjournal.com
Received: 01-09-2025
Accepted: 05-10-2025

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Management of anthracnose of green gram through fungicides under field condition

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DOI: <https://www.doi.org/10.33545/26174693.2025.v9.i12St.6779>

Abstract

Green gram (*Vigna radiata* L.) is autogamous diploid grain legume crop belonging to Leguminosae family. Although the multifaceted importance of this crop, its production could not be stabilized in almost all green gram growing areas of the country. There are several biotic and abiotic constraints hampering the production of green gram crop. Among the all diseases, anthracnose disease caused by *Colletotrichum lindemuthianum* is one of the most important fungal diseases of green gram in India. In recent past, it has become a major threat for green gram cultivation particularly in all growing region of country during the *kharif* crop season. Considering the devastating nature of the disease an effort was undertaken to assess the fungicidal efficacy to manage the anthracnose disease under field conditions. Seven different fungicides were evaluated against anthracnose disease during the *Kharif* 2024 to test the efficacy against anthracnose of green gram. Two foliar sprays of fungicides were given, first at the initiation of the disease and second at 15 days after first spray. Among all tested fungicides, two applications of ready-mix fungicide carbendazim + mancozeb at 15 days interval was found significantly effective in disease control with minimum percent disease intensity 18.88 and maximum reduction in disease over control (76.61%) at 0.15 percent concentration which was at par with tebuconazole and tebuconazole + trifloxystrobin with disease intensity 22.22 percent and 23.33 percent, respectively. Both these two fungicides, were found 72.47 percent and 71.10 percent reduction in disease over control. Maximum seed yields (1218 kg/ha) was recorded with carbendazim + mancozeb (0.15%) which was at par with tebuconazole, tebuconazole + trifloxystrobin and azoxystrobin + difenoconazole which were recorded 1180, 1150 and 1064 kg/ha seed yields, respectively.

Keywords: Green gram, anthracnose, management, fungicides

Introduction

The green gram [*Vigna radiata* (L.) Wilczek] is one of the third most important pulse crop of India after chickpea and pigeonpea. It is autogamous diploid ($2n = 22$) grain legume crop belonging to *Leguminosae* family. It is also commonly known as mung, mungbean, green gram in India and mungo in Philippines. It is quite versatile crop grown for seeds, green manure and forage and also considered as 'Golden Bean' because of its nutritional values and plays an important role in sustaining soil fertility by improving soil physical properties and fixing atmospheric nitrogen (Guan *et al.*, 2013)^[6]. So, now it becomes a popular crop for small and marginal farmers of India. It is an erect, sub-erect, deep rooted, much branched, somewhat hairy, herb with the height from 30 to 160 cm. It is an ancient and well-known leguminous crop of Asia and India. India is the principal producer of green gram in the world with an annual production of 3.17 million tonnes from an area of 5.5 million hectares with productivity of 570 kg/ha (Anonymous, 2022)^[1]. Green gram total area in Gujarat is 1104 ha, productivity 934.09 MT and yield is 1796.5 kg/ha (Anonymous, 2025)^[3]. It is a rich source of protein (24.5%), carbohydrates (56.7%), fat (1.3%) and minerals (3.5%). It also provides high quality essential amino acids like tryptophane (60 mg/g N) and lysine (460 mg/g N). It can provide some antioxidants in the form of ascorbic acid when sprouted and also contains minerals (3.84 g/100 g) and riboflavin (0.21 mg/100 gm) (Mekkarani Karthil Sudhakaran and Bukkan, 2021)^[13]. It is a fast-growing, short duration pulse crop cultivated during *summer* and *kharif* season with the minimum input requirements and performs well under heat and drought conditions. It grows in the range of temperatures of about 20 to 40 °C (Lambrides and Godwin, 2007)^[9]. On a dry weight basis, green gram contains about 25 to 28 percent protein, 1 to 1.5 percent oil, 3.5 to 4.5 percent fibre, 4.5 to 5.5 percent ash and 62 to

65 percent carbohydrate (Meena *et al.*, 2021) ^[12]. Green gram crop also suffers from many diseases caused by fungi, bacteria, viruses, nematodes and abiotic stresses (Chaudhari and Gohel, 2016) ^[5]. Green gram crop is affected by about sixty fungal, three bacterial and five viral diseases (Mukerji and Bhasin, 1986) ^[14]. Among the fungal diseases, anthracnose of green gram caused by *Colletotrichum lindemuthianum* (Sacc. & Magn.) Briosi and Cavares has become one of the serious disease of green gram. In India, the green gram anthracnose was first reported from Jorhat of Assam state during 1951 (Majid, 1953) ^[10]. Anthracnose (*Colletotrichum lindemuthianum* Sacc. and Magnus), the most economically significant of all diseases, reduced green gram yield notably (Khaire and Hake, 2018) ^[7] which causes severe leaf spotting known as “shot holes” progressing to defoliation and significantly reduces yield. The disease has been reported from all major green gram growing states of India in mild to severe form and in tropical and subtropical areas causes considerable damage by reducing seed quality and yield (Sharma *et al.*, 1971) ^[18]. The average seed yield loss of 40.18 percent and stalk yield loss of 46.90 percent was noticed due to anthracnose of green gram (Sunil *et al.*, 2009) ^[21]. Anthracnose in green gram is more common during the *kharif* season in Gujarat due to predominant favourable weather conditions throughout the crop season. The pathogen infects many crops, hence management of disease in green gram is little difficult (Buchwaldt *et al.*, 2013, Rogerio *et al.*, 2019) ^[4, 7]. Considering the severity of this disease and frequent occurrence in the fields, it has been felt necessity to develop effective management strategies. Thus, attempts have been made to evaluate the efficacy of fungicides against anthracnose disease under field condition.

Materials and Methods

The field experiment was conducted at College Agronomy Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during *Kharif* 2024 in Randomized Block Design (RBD) with eight treatments along with three replications. All the recommended agronomical practices were followed during experimentations. The seeds of green gram variety GM 4 were sown in the second week of July 2024 with 45×10 cm spacing. Two foliar sprays of fungicides were given, first at the initiation of the disease and second at 15 days after first spray. Observations on percent disease intensity and seed yield (kg/ha) were recorded. The disease intensity of anthracnose of green gram was recorded after seven days of second spray. Ten plants were selected randomly and labelled from each plot for scoring the disease intensity. The disease intensity was recorded by observing three trifoliate leaves, one each from basal, middle and upper portion of the plants. These selected plants were graded using 0-9 disease rating scale given in Table 1 (Anonymous, 2024) ^[2] on the basis of percentage area of leaves infected by the pathogen.

Table 1: Disease rating scale for green gram anthracnose

Scale	Description
0	No visible symptoms.
1	0.1-10.0 % leaf area covered with symptoms.
3	10.1-20.0 % leaf area covered with symptoms.
5	20.1-30.0 % leaf area covered with symptoms.
7	30.1-50.0 % leaf area covered with symptoms.
9	> 50 % leaf area covered with symptoms.

The Percent Disease Intensity (PDI) was calculated by using the following formula given by Mayee and Datar (1986) ^[11].

$$\text{PDI} = \frac{\text{Sum of individual numerical disease ratings}}{\text{Total no. of leaves examined} \times \text{Maximum disease scale}} \times 100$$

The percent disease control and the percent increased in yield were calculated with the help of following formula (Singh *et al.*, 2014) ^[19].

$$\text{Disease control (\%)} = \frac{\text{PDI in check} - \text{PDI in treatments}}{\text{PDI in check}} \times 100$$

$$\text{Yield increase (\%)} = \frac{\text{Yield in treatment} - \text{Yield in control}}{\text{Yield in control}} \times 100$$

Results

The content of data presented in (Table 2) revealed that all the tested fungicides for the *Kharif* 2024 were effective in reducing disease severity over control. The best control of anthracnose disease was provided by two applications of fungicides, carbendazim + mancozeb at 15 days interval with minimum percent disease intensity 18.88 and maximum reduction in disease over control (76.61%) at 0.15 percent concentration which was at par with tebuconazole and tebuconazole + trifloxystrobin with disease intensity 22.22 percent and 23.33 percent, respectively. Both these two fungicides were found 72.47 percent and 71.10 percent reduction in disease over control.

On the other hand, mancozeb, difenoconazole and copper oxychloride showed the least effectiveness among all the fungicides and were at par with each other exhibiting disease severity of 47.40, 41.85 and 40.74 percent with reduction in disease over control of 41.29, 48.16 and 49.54 percent, respectively. However, the maximum PDI of 80.74 was noticed in untreated control plot. Similarly, negative influence of anthracnose disease severity on the seed yield was observed (Table 2) in, carbendazim + mancozeb (0.15%), produced maximum yield (1218 kg/ha) with 65.04 percent increase in yield over control. While, 1180, 1150 and 1064 kg/ha yield were obtained from plots treated with by tebuconazole, tebuconazole + trifloxystrobin and azoxystrobin + difenoconazole with an increase of 59.89, 55.82 and 44.17 percent, respectively compared to untreated control and were statistically at par with best treatment. The lowest seed yield (890 kg/ha) and lowest percent increase in yield over control (20.59%) was found with mancozeb (0.2%). However, the least seed yield was recorded in untreated control (738 kg/ha).

Discussion

This Finding were close enough with the results of Kinjal and Gohel (2016) ^[8] revealed that anthracnose of green gram was effectively managed by two foliar sprays at 15 days interval starting from initiation of disease with trifloxystrobin + tebuconazole or with carbendazim + mancozeb at 0.075 percent. Singh *et al.* (2022) ^[20] recorded two sprays of carbendazim at 15 days interval gave the maximum reduction in incidence and severity of anthracnose i.e. 51.12 and 64.56 percent, respectively along with significant enhancement (53.39%) in grain yield during

both the crop seasons. The second best effective fungicide for reduction of incidence and severity was combination of carbendazim + mancozeb followed by azoxystrobin and tebuconazole. Nandeesh et al. (2023) [15] also found carbendazim + mancozeb (0.15%) a ready-mix fungicide applied at 15 days interval exhibited minimum mean percent

disease intensity of green gram anthracnose with increased in yield. As per the findings of Parmar et al., (2023) [16], carbendazim + mancozeb had the lowest disease intensity and the highest disease control followed by azoxystrobin + difenoconazole and metiram + pyraclostrobin.

Table 2: Management of anthracnose of green gram through fungicides under field condition

Tr. No.	Treatments	Conc. (%)	Disease Intensity (%)	Reduction in disease over control (%)	Seed yield (kg/ha)	Increase in yield over control (%)
T ₁	Mancozeb 75 WP	0.2	43.49 (47.40) *	41.29	890	20.59
T ₂	Copper oxychloride 50WP	0.2	39.44 (40.74)	49.54	928	25.74
T ₃	Difenoconazole 25 EC	0.05	40.24 (41.85)	48.16	946	28.18
T ₄	Tebuconazole 25.9 EC	0.05	27.99 (22.22)	72.47	1180	59.89
T ₅	Azoxystrobin 18.2 + Difenoconazole 11.4 SC	0.15	38.09 (38.14)	52.76	1064	44.17
T ₆	Tebuconazole 50 + Trifloxystrobin 25 WG	0.15	28.10 (23.33)	71.10	1150	55.82
T ₇	Carbendazim 12 + Mancozeb 63 WP	0.15	25.32 (18.88)	76.61	1218	65.04
T ₈	Control (Untreated check)	-	64.26 (80.74)	-	738	-
S. Em±			2.75	-	67.88	-
C. D. at 5 %			8.34	-	205.91	-
C. V. %			12.40	-	11.59	-

Conclusions

Studies of management of anthracnose of green gram through fungicides under natural condition revealed that out of 7 (seven) treatments, foliar spray of carbendazim + mancozeb was found to be effective in control of the disease and increased in seed yields. The next best treatment was tebuconazole and tebuconazole + trifloxystrobin which also found to be effective in managing anthracnose of green gram and increased the seed yields.

Acknowledgement

I expressed my gratitude to the Professor & Head, Department of Agronomy, Agronomy farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar for providing facilities for conducting said research work. The support of the staff of Agronomy farm is highly appreciated for helping for said research work. Additionally, I extend my thanks to authorities and staff of S. D. Agricultural University, Sardarkrushinagar for helping me for conducting the said research work in the esteemed university.

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