Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(4): 307-310
Received: 14-05-2019
Accepted: 18-06-2019

Sunil Kulkarni
Professor and Head, Department of Plant Pathology, Agricultural Research Station, Bidar University of Agricultural Sciences Raichur, Karnataka, India

Raja
Research Associate Department of Plant Pathology, Agricultural Research Station, Bidar University of Agricultural Sciences Raichur, Karnataka, India

Correspondence
Sunil Kulkarni
Professor and Head, Department of Plant Pathology, Agricultural Research Station, Bidar University of Agricultural Sciences Raichur, Karnataka, India

Assessment of grain and stalk yield losses due to anthracnose of green gram caused by *Colletotrichum truncatum* (Schw.) Andrus and Moore in Northern Karnataka

Sunil Kulkarni and Raja

Abstract
Studies were conducted to assess the grain and stalk yield losses due to anthracnose of greengram using carbendazim 50 WP in susceptible variety Chinamung. Comparatively lower disease index with increase in grain and stalk yield and also maximum BCR was recorded in plots receiving two sprays of Carbendazim. The average grain yield loss of 39.98 per cent and stalk yield loss of 47.19 per cent were noticed due to anthracnose in unsprayed plots, yield loss models using simple linear regression functions.

Keywords: green gram, anthracnose, yield loss, per cent and stalk

Introduction
Green gram (*Vogna radiate* L.) is one of the important pulse crops of India. It is quite versatile crop grown for seeds, green gram manure and forage and it is also considered as "Golden Bean". Presently in India green gram is cultivated over an area of 32.99 lakh hectare with a production of 13.74 lakh tones (Rajendra Prasad, 2006) [9]. The Hyderabad Karnataka area particularly Bidar and Gulbarga districts has an extensive cultivated area of green gram, pigeon pea and chickpea hence this region are called as "Pulse Bowl" of Karnataka. In Karnataka anthracnose caused by *Colletotrivhum truncatum* (Schw.). Andrus and More is one of the major diseases of green gram. In Northern Karnataka Anthracnose severity in the range of 18.2 to 86.5 % per cent (Laxman, 2006) [5]. Keeping this in view, the study was undertaken to assess the loss in grain and stalk yield.

Materials and Methods
Field experiments were conducted at Agricultural research Station, Bidar to find out the number of sprays of Carbendazim 50 WP required to manage anthracnose in susceptible green gram variety *viz*., Chinamung to assess the influence of fungicide spray on grain and stalk yields. The crop was sown in 3.0 x 5.0 m^2 plots keeping a spacing of 30 x 10 cm in randomized block design with five replications. Three treatments were imposed with 0.1 per cent. Carbendazim besides a treatment with unsprayed control. The details of treatments as given below.
T_1- One spray [at 20 days after sowing (DAS)]; T_2- Two spray (at 20 and 30 DAS); T_3- Three sprays (at 20, 30 and 40 DAS) and T_4- No spray (Control)
The disease severity was recorded at different crop growth stages *viz*. 25, 32, 39, 46, 53 and 60 DAS. The intensity of the disease was recorded by scoring all the tagged ten plants in each treatments using 0 to 9 scale of Mayer and Datar (1986) [7]. Further, the PDI was calculated with the above scales using the formula of Wheeler (1969) [16] at weekly interval. Crop was harvested after maturity of pods and grain and stalk yields of net plot were recorded as kg per ha and later expressed in quintals per ha. The per cent loss in grain and stalk yield was calculated by using following formula

$$\text{Per cent Yield Loss} = \frac{Yp\text{-}Yk}{Yp} \times 100$$

Where, Yp= Potential yield and Yx= Yield when per cent disease severity is x
Further, an attempt was made to identify the relationship between yield and level of incidence of disease in the form of PDI by taking observations on disease at weekly intervals staring from 25 to 60 DAS of the crop. Crop loss models for

Green gram anthracnose were developed using simple linear regression functions in the form Y= a+bx with Y as yield in quintals and x as per cent disease index. The square of the coorelation coefficient (r) known as coefficient of determination (R^2) was calculated to know the extent to which the model is capable of explaining the relation between the yield and the PDI.

Results

Per cent disease index (PDI): Table 1 indicated that, the PDI was significantly less in treated plots with fungicide at 25 DAS compared to control. The disease progress from 25 to 60 DAS was very fast in control treatments (16.07 to 60.08%) compared to one time fungicide sprayed plots (10.36% to 26.52%). Further, the PDI in treatment received two and three applications of fungicides have not shown significant difference at 32 and 39 DAS. Disease was reduced to an extent 54.01 to 58.05 per cent when sprayed two and three times, respectively.

Grain yield: The lowest grain yield was recorded in untreated control (7.28 q/ha), whereas, it was 9.09, 12.01 and 12.13 q per ha at one, two and three times sprayed plots, respectively. The highest increase in grain yield of 66.62 per cent was recorded in three sprays followed by two (64.97%) and one (24.86%) spray (Table 1).

Stalk yield: Maximum stalk yield was recorded in plots received three sprays (14.26 q/ha) and was found on par with two sprays (14.10 q/ha). The increase in stalk yield ranged from 22.44 to 89.38 per cent in one to three sprays (Table 1).

Loss in grain and stalk yield: The loss in grain yield due to anthracnose was to the tune of 39.98 per cent in control plot, whereas it was least (0.98%) in plots received two sprays. The highest loss in stalk yield was also recorded in control plot (47.19%) followed by plots received one (35.34%) and two (1.12%), sprays of carbendazim (Table 2).

Benefit: Cost ratio (BCR): Maximum BCR of 16.43 was obtained from the treatments received two sprays followed by one spray (12.91) and three sprays (10.87) (Table 2).

Crop loss model: The investigation on crop loss due to anthracnose of green gram was carried out and also an attempt was made to identify the relationship between grain and stalk yield and level of per cent disease index at weekly interval from 25 to 60 DAS in susceptible variety Chinamung. Simple linear regression models were developed and presented in Table 3.

Maximum correlation coefficient of 0.89 was obtained between the PDI and the grain yield recorded at 60 DAS, the coefficient of determination (R2) of 0.79 were obtained. Further, the observed and predicted grain yield values were compared and found that there was no much deviation.

Table 1: Crop loss assessment due to anthracnose of green gram caused by *Colletotrichum truncatum*

S. No	Treatment (Carbendazim At 0.1%)	Percent Disease Index at DAS						Percent reduction over control	AUDPC (A) value	Per cent decrease of A value over control	Grain yield (q/ha)	Percent grain yield increase over control	Stalk yield (q/ha)	Percent stalk yield increase over control
		25	32	39	46	53	60							
1	T_1 - One spray	10.36 (18.90)*	15.38 (23.09)	18.42 (25.41)	22.03 (27.99)	22.95 (28.62)	26.52 (30.99)	46.95	680.54	46.04	9.09	24.86	9.22	22.44
2.	T_2 - Two sprays	9.75 (18.19)	14.45 (22.34)	15.47 (23.33)	18.86 (25.73)	19.60 (26.28)	22.00 (27.97)	54.01	589.79	53.24	12.01	64.97	14.10	87.25
3.	T_3 - Three sprays	9.53 (17.97)	14.24 (22.17)	14.64 (22.49)	16.13 (23.67)	17.94 (25.06)	19.08 (25.90)	58.05	540.79	57.12	12.13	66.62	14.26	89.38
4.	T_4 - No spray	16.07 (23.62)	22.05 (28.00)	28.09 (32.00)	41.03 (39.83)	50.93 (45.53)	60.08 (50.82)	-	1261.23	-	7.28	-	7.53	-
	S.E m ±	0.27	0.15	0.23	0.21	0.14	0.21				0.10		0.12	
	CD at 5 %	0.84	0.45	0.83	0.66	0.43	0.64				0.32		0.38	

* Values in parenthesis are arc sine transformed values.
DAS: Days after Sowing

Table 2: Effect of number of sprays of carbendazim on severity of anthracnose, yield parameters and benefit: cost ratio in green gram

S. No.	Treatment	PDI	Grain yield		Stalk yield		BCR
			Yield (q/ha)	Loss over T_3 (%)	Yield (q/ha)	Loss over T_3 (%)	
1	T_1 – One spray	19.27	9.09	25.06	9.22	35.34	12.91
2	T_2 - Two sprays	16.68	12.01	0.98	14.10	1.12	16.43
3	T_3 - Three sprays	15.26	12.13	0	14.26	0	10.87
4	T_4 - No spray	36.37	7.28	39.98	7.53	47.19	-

Table 3: Crop loss models showing the relationship between anthracnose PDI and yield (q/ha) of green gram

Model for yield	r	R^2
Y=14.825 – 0.214 PDI	-0.89	0.79

Discussion

Per cent disease index: Maximum disease severity was recorded in treatment where no spray of carbendazim was taken in both the years. Whereas, the disease severity was very less in rest of the treatments where one to three sprays of carbendazim were taken. Among the sprayed treatments, one spray treatment recorded higher disease severity of 19.27 per cent than other treatments at all time of observations. So also, in crop receiving two sprays recorded significantly higher disease index of 16.68 per cent than plots receiving three sprays. The least disease severity was noticed in three sprays (15.26%) of experiment.

The disease reduction to the tune of 58.05 per cent was observed respectively on crops sprayed with three times, while it was comparatively less in crop received one spray. Effectiveness of fungicidal sprays to lower the disease advancement is on record (Bharadwaj and Thakur, 1991; Shirshikar, 1995; Varaprasad, 2000; Madhusudhan, 2002 and Laxman, 2006) [3, 11, 15, 6, 5]

AUDPC values gives an idea of disease progression over a period of time, which in turn reveals the yield loss. In the present investigation, the AUDPC values of anthrcnose reduced considerably with increased number of sprays of carbendazim. These findings are in agreement with those of Benagi (1995) [2], who reported the reduction in AUDPC

values of late leaf spot of groundnut with increased number of chlorothalonil sprays. Similar views were expressed by Amaresh (2000) [1] in Alternaria leaf blight of sunflower.

The results of the experiments clearly indicated that two fungicidal sprays are sufficient to reduce the disease severity. Similar views were put forth by Bharadwaj and Thakur (1991) [3], Madhusudhan (2002) [6], Deeksha and Tripathi (2002) [4] and Laxman (2006) [5].

Grain yield: Application of fungicide significantly improved the grain yield than untreated control (no spray). Maximum yields were obtained from the plots sprayed with two and three times, which were attributed to the lower disease index in these treatments.

The grain yield loss was to the tune of 39.98 per cent in the absence of control measures of the disease. So, by minimizing the anthracnose severity, the yield loss could be reduced considerably. The disease incidence was higher in control plots than fungicide applied plots, thus indicating relationship between the disease and also yield. The data revealed that, yield was reduced drastically in control plots as compared to fungicide applied plots. The yield was significantly higher in two sprays of carbendazim (12.01 q/ha) than one spray of carbendazim and also disease intensity was low in two sprays of fungicide. These findings are in accordance with the reports of Bharadwaj and Thakur (1991) [3], Madhusudhan (2002) [6], Deeksha and Tripathi (2002) [4] and Laxman (2006) [5].

Therefore, the results of field studies proved that, two sprays of carbendazim are sufficient to manage the disease and realize the economic yields.

Stalk yield: Similarly, spraying of fungicides significantly increased the stalk yield. The maximum stalk yield were obtained in plots receiving two to three sprays which is mainly due to lower disease index in these treatments. Increase in stalk yields are recorded from plots receiving (14.10 q/ha) two and three (14.26 q/ha) sprays than plots receiving one spray (9.22 q/ha) and untreated control (7.53 q/ha). These findings are in line with the reports of similar views obtained by Benagi (1995) [2] in late leaf spot of groundnut and Deeksha and Tripathi (2002) [4] in anthracnose of blackgram. Therefore, studies indicated that giving two sprays could help to enhance the stalk yield level in green gram by way of controlling the disease.

Benefit: Cost ratio: Higher benefits were recorded from treatments with one and two sprays of carbendazim (0.1%) against anthracnose in green gram. This is in agreement with the earlier report of Madhusudhan (2002) [6], Deeksha and Tripathi (2002) [4] and Laxman (2006) [5]. Though, the benefits were same in both the treatments farmers have to lose 2.83 and 4.65 q per ha of grain and stalk yield, respectively if they spray the crop once when compared to two fungicidal applications which are sufficient to overcome the outbreak, but it cannot be practical to sacrifice 2.83 and 4.65 q per ha of grain and stalk yield, respectively to obtain higher benefits.

It may be inferred that, two sprays of carbendazim are essential to obtain maximum yield. When disease pressure is moderate to low, one spray of carbendazim (0.1%) is enough to realize maximum benefit. Whereas, when disease pressure is very high, two sprays of carbendazim are necessary to realize maximum benefits. Benefit: cost ratio is important for economic feasibility of farming community.

Crop loss model: Crop loss model plays a vital role in the prediction and forecasting of loss due to anthracnose, which is a pre-requisite for determining decision in thresholds and deployment of cost effective management practices. Hence, importance of disease is adjudged based on the loss in yield caused by the disease. Several workers have indicated the loss in yield (Schneider *et al*., 1976) [10] of green gram crop against leaf spot and groundnut late leaf spot (Benagi, 1995) [2].

Accurate information of loss is needed by farmer and plant protection specialists to develop decision thresholds for determining when cost effective management strategy should be deployed (Nutter, 1993) [8]. In the present study, yield loss models were developed by using PDI as input variable to predict loss due to anthracnose. Highly significant correlation coefficient (r) and coefficient of determination (R2) were obtained for yield predictions with input variable PDI. Hence, the simple linear regression crop loss model was developed which depicts maximum correlation with given PDI and predicted yield. Model developed only helps to calculate the yield with given PDI. As fitting of the model is dependent on maximum R2, it can fit anywhere from PDI taken at 25 to 60 DAS.

The relationship between PDI and yield were significant and negatively correlated, indicating that increase in per cent disease index leads to decrease in yield of green gram. This is in agreement with Sud and Singh (1985) [13], who reported that the grain yield was negatively related to the severity of leaf spot and positively to green leaf area in case of blackgram. Regression equation showed that, there was a linear relationship between per cent disease index and yield. The fungus obtains nutrients from host and reduces the photosynthetic area of the leaf due to dark brown chlorotic spot on leaf. Thus, photosynthesis and translocation are affected which results in reduction in yield. Similarly, Singh and Shukla (1988) [12] reported that premature defoliation, affects the yield greatly and pod infection may result in complete loss in yield.

The significant coefficient of determination (R2) clearly indicated the validity of the model developed. In the present study, the predicted yield loss values were nearer to the observed values and indicated that, the linear regression models fitted by using variable PDI is appropriate for prediction of yield loss due to anthracnose of green gram. Van der Plank (1963) [14] suggested that yield loss may be related to disease and demonstrated the relationship using linear regression equation.

Conclusion

The observations on loss estimation revealed that comparatively lower disease index with increase in grain and stalk yield and also maximum BCR was recorded in plots receiving two sprays of carbendazim. The grain yield loss of 39.98 per cent and stalk yield loss of 47.19 per cent were noticed due to anthracnose in unsprayed plots.

References

1. Amaresh. Epidemiology and management of Alternaria leaf blight and rust of sunflower (*Helianthus annus* L.). Ph. D. Thesis, Univ. Agric. Sci., Dharwad, Karnataka, India, 2000.
2. Benagi VI. Epidemiology and management of late leaf spot of groundnut caused by *Phaeoisarioipsis personata* (Berk and Curt.) V. Arx. Ph. D. Thesis, Univ. Agric. Sci., Dharwad, Karnataka, India, 1995.
3. Bharadwaj CL, Thakur DR. Efficacy and economics of fungicide spray schedules for control of leaf spots and pod blights in urdbean. Indian Phyto pathol. 1991; 44(4):470-475

4. Deeksha J, Tripathi HS. Cultural, biological and chemical control of anthracnose of urdbean. J. Mycol. Pl. Path. 2002; 32(1):52-55.
5. Laxman R. Studies on leaf spot of green gram caused by *Colletotrichum truncatum* (Schw.) Andrus and Moore. M. Sc. (Agri.) Thesis, Univ. Agric. Sci., Dharwad, Karnataka, India, 2006.
6. Madhusudhan BS. Studies on soybean anthracnose caused by *Colletotrichum truncatum* (Schw.) Andrus and Moore. M. Sc. (Agri.) Thesis, Univ. Agric. Sci., Bangalore, Karnataka, India, 2002.
7. Mayee CD, Datar VV. Phyto pathometry. Technical Bulletin-I, Marathawad Agricultural University, Parbhani, India, 1986, 146.
8. Nutter FW. Terms and concepts for yield, crop loss and disease thresholds. Plant Disease. 1993; 77:211-215.
9. Rajerndra Prasad, Textbook of field crops production. Pub. Directorate of Information and Publication of Agriculture, ICAR, New Delhi, 2006, 258.
10. Schneider RW, Williams RJ, Sinclair JB, Cercospora leaf spot of cowpea: Models for estimating yield loss. Phytopathology. 1976; 66:384-388.
11. Shirshikar SP, Studies on seed borne nature and cultural aspects of *Colletotrichum truncatum* (Schw.) Andrus and Moore; incitant of anthracnose disease of soybean (*Glycine max* (L.) Merrill). Ph. D. Thesis, Univ. Agric. Sci., Bangalore, Karnataka, India, 1995.
12. Singh RR, Shukla P. Colletotrichum leaf blight of blackgram. Farm Sci. J, 1988; 3:97-102.
13. Sud VK, Singh BM. Relationship between severity of Cercospora canescens on urdbean and loss in grain yield. Indian Phyto pathol. 1985; 38(3):435-441.
14. Van der Plank JE. Plant Disease: Epidemics and control, Academic Press, New York. 1963, 35-71.
15. Varaprasad CH. Studies on blight disease of chickpea caused by *Colletotrichum dematium* (Pers. Ex. Fr.) Grove. M.Sc. (Agri.) Thesis, Univ. Agric. Sci., Dharwad, Karnataka, India, 2000.
16. Wheeler BEJ. An introduction to plant disease, John Wiley and fungi. Phytopathology. 1969; 22:837-845.