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Evaluation of organic amendments against *Colletotrichum truncatum* causing anthracnose of Soybean under greenhouse conditions

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ABSTRACT

Eight sources of organic matter viz., Tea waste, poultry manure, Wheat straw, Cow dung, sugarcane bagasse, Neem cake, Mustard leaves and Saw dust were evaluated under greenhouse condition for their effectiveness to manage anthracnose of Soybean caused by C.. truncatum. All eight treatments were significantly effective in minimising the diseases severity out of which Neem cake was found most effective and gave highest seed germination (82.20%), Vigour index (3504) and nodulation (26.66) and showed least disease severity (13.85%). Whereas minimum pre-emergence mortality in Tea waste with 12.99% while the post emergence mortality was found least in Neem cake with 4.60%. The current finding concentrates on the eco-friendly alternatives to manage anthracnose of Soybean in the field over the conventional chemical pesticides.

***Key words**: Organic matter, greenhouse, anthracnose, management*

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INTRODUCTION

India is one among the largest producers of vegetable oil in the world. The increasing per capita income and rate of consumption are accelerating the demand for edible oils. Soybean (Glycine max) (L.) oil account for nearly half of total edible oil consumption in India. Soybean Merrill) is an important leguminous crop, also called as a 'miracle crop' due to its multiple uses, originated in China **(Hymowitz, 1970).**

As legume crop it is capable of utilizing atmospheric nitrogen through fixation. Soybean cultivation fixes 20-30 kg N/ha for wheat crop and also maintain soil conditions by increasing the organic carbon in sandy soil **(Tiwari, 2006).** Low productivity is mainly due to short growing period, narrow genetic base of soybean and biotic as well as abiotic stresses. Among biotic stresses, diseases are the major factor caused by several pathogens are responsible for low production and productivity of soybean in India. Diseases caused by different plant pathogens are mainly a world wide problem in production of soybean. In world record, more than 100 diseases have been identified which causes economic losses to the soybean **(Sinclair and Backman, 1989)**. In India 23 disease are reported across the country. Among them, anthracnose (pod blight) is a serious disease, since it directly affects the grain quantitatively(about 34% yield loss) as well as qualitatively(13% protein, 3% fat loss). *Colletotrichum dematium* var. *truncata* (Schw.) Andrus and Moore] which is considered as the major causal organism of anthracnose (pod blight) disease of soybean which is most geographically widespread on soybean crop as well as the species which is most frequently isolated from plant parts of soybean **(Arx, 1957; Athow, 1987; Bryant and Walters, 1980; Hepperly *et al.*, 1983; Lenne, 1992; Miller and Roy, 1982; Roy, 1982; Sinclair and Backman, 1989; Tiffany and Gilman,1954)**. It is an important disease under warm and humid conditions **(Sinclair and Backman, 1989),** especially in the tropics **(Hepperly *et al.*, 1983).** *C. dematium var. truncata (Colletotrichum truncatum)* is the most common species recorded on soybean **(Lenne 1992).**

MATERIALS AND METHODS

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Vol-22-Issue-34-December -2019

Method of mixing of certain organic matter sources in soil

Eight sources of organic matter *viz.;* Tea waste, poultry manure, Wheat straw, Cow dung, sugarcane bagasse, Neem cake, Mustard leaves and Saw dust were used. Ten gram of each organic source material was mixed separately with 1 kg of soil. The soil amended with different sources of organic matter were shifted in 2.0 kg capacity plastic pots and allowed to recycle its ingredients for 25 days. Non-amended soil was served as control. Uniform moisture was maintained throughout the decomposing period. Plastic pots with 30 cm size diameter were kept in glass house. They were filled with each organic matter recycled soil and placed on greenhouse shelves. The potted soil was then inoculated with test pathogen. The temperature was maintained at 26±3^{o}C **(Bhardwaj, 2012)**. Pots were watered as per requirement after planting. Soybean seedsof variety "NRC-89" were sown in the pots @ 10 seeds per pot. Three pots were were used as replication for each treatment. Three pots were maintained without mixing test pathogen as check. The pots were watered frequently for maintaining optimum amount of soil moisture.

Method of Evaluation

Page of germination was observed after 7 days of sowing with the given below formula:

$$\text{Germination percent} = \frac{\text{Seeds germinated}}{\text{Total seeds sown}} \times 100$$

$$\text{Vigour Index} = \text{Seed germination} \times \text{Seedling length}$$

Seedling mortality was observed 15 DAS and finally percent disease index was observed 45DAS in 0-9 Scale proposed by AICRP-Soybean-Technical Bulletin 2010-11(Table 1).

ISSN:0971-1260
Vol-22-Issue-34-December -2019

Table 1. Rating scale used for recording of disease severity:

Rating	Description
0	Number lesions per spots on pods
1	1% leaf area infected with lesions/spots
3	1.1-10%leaf area infected with lesions/spots, no spots on stem
5	10.1-25% leaf area infected, no defoliation, little damage
7	25.1-50% leaf area infected ; some leaves drop; death of few plants; damage conspicuous
9	More than 50% leaf area infected, lesions/spot very common on all plants, defoliation common; death of plants common; damage more than 50%.

Five plants per plot were randomly observed for taking readings. On the basis of infected leaf area, leaves of each plant were rated as per (0-9) rating scale by using the following formula:

$$\text{Per cent disease index (\%)} = \frac{\text{Summission of all numerical rating}}{\text{Total number of sample x Maximum rating grade}} \times 100$$

ISSN:0971-1260
Vol-22-Issue-34-December -2019

RESULT AND DISCUSSION

Effect of organic amendments in soil, inoculated with the test pathogen

Glass house experiment was conducted to check the compatibility and interection effect of different organic amendments in soil inoculated with test pathogen. Various observations i.e. seed germination , seed and seedling mortality nodulation and Disease severity. The data is presented in **Table 1.**

Seed germination

Significantly maximum seed germination was recorded in Neem cake (82.20%) followed by Tea waste (78.90%), Sugarcane bagasse (72.66%) Poultry manure (66.60%) Cow dung (63.33%), Wheat straw (56.60%) , Mustard leaves (53.33%) and Saw dust (48.66%) as compared to check (32.80%). Germination in different types of organic matter amended soils were significantly different to each other.

Pre - emergence mortality (Seed rot)

Significantly minimum seed rot was observed in Tea waste (12.99%) followed by Neem cake (14.22%), Sugarcane bagasse (16.43%), Cow dung (18.69%), Poultry (21.22%), Wheat straw (25.42%), Mustard leaves (26.66%) and saw dust (48.66%) as compared to check (39.46%). The seed rot in different types of organic matter viz. Tea waste, Neem cake, Cow dung, Poultry manure and Wheat straw amended soils were significantly at par to each other, but the seed rot was signicantly similar to Cow dung, Wheat straw, Mustard leaves and Saw dust amended soils.

Seedling blight (Seedling rot)

Significantly minimum seedling infection was observed in Neem cake (4.60%), followed by Tea waste (7.30%), Poultry manure (8.33%), Sugarcane bagasse (10.63%), Cow dung (11.10%), Saw dust (13.04%) Mustard leaves (14.60%) and Wheat straw (19.43%) as compared to check (26.40%), but above- said amended soils were significantly at par in exhibiting the seedling infection.

Vigour Index

Significantly maximum vigour index was recorded in Neem cake (3504) followed by Tea waste (3152.33), Sugarcane bagasse (2547.66), Poultry manure (2221.33), Cow dung (2106.66),

ISSN:0971-1260
Vol-22-Issue-34-December -2019

Mustard leaves (1790), Wheat straw (1466.66) and Saw dust (1110) as compared to check (1086). The vigour index in Neem cake was significantly at par to Tea waste.

Nodulation

Significantly maximum number of nodules were recorded in Neem cake (26.66) followed by Sugarcane bagasse (24.00), Tea waste (19.33), Cow dung (18.66), Poultry manure (13.67), Wheat straw (10.33), Mustard leaves (9.66) and Saw dust (8.42) as compared to check (3.86). The number of nodules were significantly similar in Neem cake and Sugarcane bagasse, but number of nodules in Sugarcane bagasse amended soil and Tea waste were significantly different to each other.

Tea waste and Cow dung were significantly similar to each other. While, Cow dung and Poultry manure were significantly different to each other. Poultry manure, Wheat straw and Mustard gave significantly different nodules number. The nodules number were significantly different in Saw dust and Mustard leaves.

Significantly maximum Nodules dry weight was recorded in Neem cake (12.93mg) followed by Sugarcane bagasse (11.73mg), Tea waste (9.80mg), Cow dung (9.00), Poultry manure (6.67mg), Wheat straw (5.6mg), Mustard leaves (5.3 mg) and Saw dust (4.6mg) as compared to check (1.32). Neem cake and Sugarcane bagasse were significantly at par to each other, but Tea waste and Cow dung gave significantly similar results. Cow dung and Poultry manure were significantly different to each other. Whereas, Poultry manure and Wheat straw gave significantly similar results. Wheat straw, Mustard and Saw dust were significantly at par in their effects on nodules dry weight.

Disease severity (PDI)

Significantly minimum disease severity (PDI) was reported in Neem cake (13.85%) followed by Tea waste (23.46%), Sugarcane bagasse (37.79%), Poultry manure (46.93%), Cow dung (54.90%), Wheat straw (60.46%), Mustard leaves (63.33%) and Saw dust (74.90%).

ISSN:0971-1260
Vol-22-Issue-34-December -2019

CONCLUSION

In the present investigation maximum seed germination (82.20%) as well as seedling vigour (3504) and minimum disease severity was observed in Neem cake (17.86%) amended soil whereas minimum pre-emergence mortality was found in Tea waste(12.99%), while minimum post-emergence mortality was recorded in Neem cake (4.60%). The results could be correlated with the studies done by **P. A. Abbasi *et al.* (2002)** who found that the disease incidence of anthracnose fruit rot was reduced in tomato plots amended with composted cannery wastes in comparision with non amended control plots. Based on the present investigation Neem cake, Tea waste and Sugarcane bagasse amended pods were found effective and they may have economic significance in the control of test pathogen , as it survives in the soil with crop debris in form of mycelia which produces abundant conidia in crop season . Inhibition of mycelial growth by these soil ammendments may help to reduce the inoculum potential and thereby reduce disease intensity in its ensuing season.

ISSN:0971-1260
Vol-22-Issue-34-December -2019

Table no. 1 Effect of Organic amendments in soil, inoculated with test pathogen on germination, pre- and post- emergence mortality, vigour index, nodulation and disease severity.

S. No.	Treatment	Germination (%)	Pre-emergence mortality (%)	Post-emergence mortality (%)	Vigour Index	Nodulation		Percentage Disease index
						Nodules number/Plant	Nodules dry weight/plant	
1.	Tea waste	78.90	12.99	7.30	3152.33	19.33	9.80	24.03
2.	Poultry manure	66.60	21.22	8.33	2221.33	13.67	6.67	33.45
3.	Wheat straw	56.60	25.42	19.43	1466.66	10.33	5.6	46.05
4.	Cow dung	63.33	18.69	13.04	2106.66	18.66	9.00	35.56
5.	Sugarcane bagasse	72.66	24.43	10.63	2547.66	24.00	11.73	28.31
6.	Neem cake	82.20	14.22	04.60	3504	26.66	12.93	13.85
7.	Mustard	53.33	26.66	14.6	1790	8.42	4.6	53.53
8.	Saw dust	48.66	30.33	11.10	1110	9.66	5.3	56.09
9.	Control	32.80	39.46	26.40	1086	3.86	1.32	62.58
CD at 5 %		7.25	9.52	15.01	429.27	4.13	2.00	3.76
SEm.±		2.39	3.13	4.94	141.54	1.36	0.66	1.24

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Vol-22-Issue-34-December -2019

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Vol-22-Issue-34-December -2019

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