



Evaluation of Different Management Practices against *Alternaria* Leaf Blight Disease of French Bean (*Phaseolus vulgaris* L.) caused by *Alternaria alternata*

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ABSTRACT: French bean (*Phaseolous vulgaris* L.) is a substantial food crop utilized as a pulse and green vegetable crop, belongs to family Fabaceae. *Alternaria* leaf blight disease is one among the major constraints of crop production incited by *Alternaria alternata* resulting into significant yield loss as well as in quality of pods. In this context, Experiments was laid out in randomized block design with five replications for three consecutive years during 2019-2022. Evaluated different treatment of farming systems such as natural farming, organic farming, chemical farming and recommended package of practices (UHS, Bagalkot) for their bio efficacy to combat the disease. A pooled severity of three years analyzed, among the management practices, chemical farming comprises mancozeb 75% WP@2gm/lit. was found effective in managing the disease (3.45% PDI) and showed consistent trend for all three years of experimental period which is followed by recommended package of practice comprises propiconazole 25%EC @1ml/l (6.26% PDI), organic farming comprises of talk-based *Trichoderma harzianum* 10g/lit (7.22% PDI). Natural farming comprises sour butter milk (5lit. per 200 lit. of water) found least effective to combat disease and recorded maximum disease severity (12.22% PDI) at 45DAS. Although chemical farming can effectively control the disease but it will lead to serious risk on human health and environmental hazards. Therefore, organic and natural farming are an alternative approach that are eco-friendly and economically viable against *Alternaria* leaf blight disease management.

Keywords: French bean, Natural farming, Chemical farming, *Alternaria*, Trichoderma.

INTRODUCTION

French bean (*Phaseolous vulgaris* L.) is a significant food, leguminous crop utilized as a pulse and green vegetable crop, belongs to family fabaceae. The most important species of *Phaseolus* is the French bean, which native to Central and South America (Swaidner *et al.*, 1992). It is a diploid (2n=22) annual species (Galvan *et al.*, 2003). The French bean is a cool-season, day-neutral leguminous vegetable that can withstand

extreme temperatures (Govardhani *et al.*, 2022). It is mostly grown in North America and Europe, including the United States, England, Brazil, Poland, Myanmar, Mexico, China, and India. According to national horticulture board, it is cultivated in an area of 228 thousand hectare and production of 2277 thousand MT with productivity of 9.98 MT per hectare (Anon, 2018). In short time period it will generate more money to farmers. In the tropics and subtropics, *Alternaria* leaf

blight is the most serious stumbling block to French bean production, with an estimated annual loss of 0.39 million tonnes (MT). Sami (1969) first time reported the symptoms of *Alternaria* leaf blight of French bean. Initial symptoms of the disease as small, brown, irregular lesions that grew in size and became dark brown in colour, oval in shape and with indistinct zonations. The lesions frequently merged, resulting into huge necrotic areas. On rare occasion, partial defoliation begins with the lowest leaves was also observed this will leads to reduced plant vigour and yield loss. Yield loss, often exceeds more than 50 per cent (Wortmann *et al.*, 1998; Allen *et al.*, 1998). Humid weather and temperature near 20°C are favorable disease epidemic (Nasraoui, 2008). Wind, rain, insects and seed easily propagate spores formed from infected plants. Chemical management to combat this pathogen has yielded positive effects on occasion but inappropriate use of fungicides frequently results in environmental pollution and resistance in pathogen (Batta, 2000; Rajatiya *et al.*, 2018; El-Gali, 2015; Sharma *et al.*, 2020). Since couple of years, an increasing consciousness and importance about environmental pollution due to chemicals and even development of fungicide-resistant strain in *Alternaria alternata* has challenged the plant pathologists to search for non-toxic fungicides for substituting the recommended chemicals (Ozkilinc and Kurt 2017; Yang *et al.*, 2019). Biological control is considered an important approach for controlling many fungal plant pathogens and exploration for new biological agents is increasing as potential biological control antagonists. *Trichoderma harzianum* is most promising and effective biocontrol agent (Govardhani *et al.*, 2022). Sour butter milk which comprises millions of beneficial *Lactobacillus* act as antifungal activity against *Alternaria alternata* (Garg and Kumhar 2020). One such attempt has been made to evaluate the efficacy of different management practices comprises Mancozeb 75% WP, Propiconazole 25% EC, *Trichoderma harzianum* 10 gm/lit, sour butter milk as spray against *Alternaria* leaf blight of French bean.

$$\text{Percent disease index (\%)} = \frac{\text{Sum of all disease ratings}}{(\text{Total number of rating} \times \text{Maximum disease grade})} \times 100$$

Statistical Analysis. In this investigation, field experiment was carried out randomized block design. The data obtained from all the experiments were statistically analyzed following the standard procedures (Gomez and Gomez 1984).

RESULT AND DISCUSSION

The data pertaining to Table 2 and 3 revealed that among the four different management practices against *Alternaria* leaf blight disease in French bean. Disease severity was expressed in terms of Per cent Disease Index (PDI). Spray had taken after first appearance of

MATERIAL AND METHODS

Experimental details. The field trial was carried out at experimental field of Natural farming project (Zone-9), College of Horticulture, Sirsi (Latitude 14.6039° N and longitude 74.8467°E) Uttara Kannada district of Karnataka, India during 2019-2022. The experiment was laid out in randomized block design with 5 replications using Arka Sharad variety of French bean. Seeds were sown at plant to plant and row to row spacing 45cm × 45cm, respectively. The fertilizers were applied at the rate of N:P:K- 63:100:75 Kg/ha. and FYM at the rate of 25 T/ha. Other intercultural operations were practiced as recommended by University of Horticultural Science, Bagalkot for commercial cultivation of French bean. Treatment were imposed after appearance of symptoms and severity was recorded subsequently at 15 days intervals after sowing. It included spraying of Propiconazole 25EC@1ml/l. from chemical farming and Mancozeb 75%WP 2g/lit. from recommended package of practice. *Tichoderma harzianum* 10gm/lit. (talc-based formulation) from organic farming and sour butter milk (5 liters per 200 liters of water) from natural farming.

Morphologica characterization of *Alternaria alternata*. Conidial morphology was studied with the help of ocular microscope at 40X microscopic field.

Measurement of *Alternaria* leaf blight disease severity in French bean. After germination, the crop was regularly watched for first appearance of disease. The observation on disease intensity was recorded using a progressive 0-5 scale, as showed in Table 1. Numerical rating grade was given on the basis of percentage of area infected by pathogen on the leaves (McKinney, 1923).

Table 1: Disease description scale for *Alternaria* leaf blight disease in French bean.

Grade	Infection
0	No blight-on leaves (Healthy)
1	0-10% leaf area covered
2	11-25% leaf area covered
3	26-50% leaf area covered
4	51-75% leaf area covered
5	76-100% Leaf area covered

disease in field and disease severity was recorded at intervals of 15, 30 and 45 days after sowing. Among the management practices, chemical management showed significant different with other management practices with respect to any spray intervals. Chemical farming (Propiconazole 1ml/lit.) showed effective control against disease recorded 4.97 PDI, 4.30 PDI and 3.35 PDI at 15, 30 and 45 days of intervals, respectively. Arun Kumar (2008) revealed effectiveness of propiconazole against *Alternaria alternata* of chrysanthemum. It was found also effective against *Alternaria* leaf spot of Jerusalem Artichoke

(Viriyasuthee *et al.*, 2019). Sharma *et al.* (2020) found propiconazole was effective against *Alternaria* blight of cluster bean and produced maximum yield among the other treatments. Recommended package of practice (Mancozeb 75WP@2gm/lit.) found second best fungicide recorded 8.47 PDI, 6.94 PDI and 6.26PDI. at 15, 30 and 45 days of intervals, respectively results are in confirmatory with Sharma *et al.* (2020); Chandrashekar *et al.* (2022) who found mancozeb as effective chemical against cluster bean and French bean respectively. Organic farming (*Trichoderma harzianum*10g/lit.) found potential antagonist against *Alternaria* leaf spot recorded 9.50 PDI, 8.75 PDI and 7.22 PDI at 15, 30 and 45 days of intervals, respectively. Chandrashekar *et al.* (2022) revealed effectiveness of *Trichoderma harzianum* strain over other bioagents against French bean *Alternaria* leaf spot. finally, natural farming (Sour butter milk -5 lit. per 200 lit. of water) found leaf effective against *Alternaria* leaf spot disease recorded. Lactoferrin B and

lactic acid bacteria present in sour butter milk are the major anti-microbial proteins. Lactic acid bacteria (LAB) also produces anti-bacterial and anti-fungal metabolites such as cyclic dipeptides, 3-hydroxylated fatty acid, phenyl lactic acid and various proteinaceous compound these all exhibit antimicrobial property (Gajbhiye *et al.*, 2018). Hence in our research finding sour butter milk found bit effective against disease hence these results are in confirmatory with Garg *et al.* (2020) who found effectiveness of sour butter milk against *Alternaria* leaf blight in tomato.

Morphological Characters of *Alternaria alternate*. The conidia were simple, obclavate, pale to dark brown in color and mostly formed in chains. Conidia comprises both transverse and vertical septa (muriform) conidia. Conidiophores pale to dark brown in color. Hyphae were brown with light brown conidiophores at the top of each branch which is indicated in Fig. 1 (Meena *et al.*, 2014).

Table 2: Evaluation of different farming practices for management of *Alternaria* leaf blight disease in French bean.

Treatment	Before spray	Per cent Disease Index											
		2019-20			Before spray	2020-21			Before spray	2021-22			
		15 DAS [#]	30 DAS	45 DAS		15 DAS	30 DAS	45 DAS		15 DAS	30 DAS	45 DAS	
T ₁	RPP	22.50±0.7 (28.31)	*8.51±0.2 ®(16.96)	5.71±0.2 (2.37)	5.60±0.2 (2.47)	20.50±0.7 (27.31)	9.25±0.6 (3.04)	8.12±0.8 (2.83)	6.86±0.9 (2.60)	20.50±0.7 (27.31)	7.67±0.8 (2.75)	7.00±0.7 (2.63)	6.33±0.3 (2.51)
T ₂	OF	21.45±0.8 (27.58)	9.58±0.2 (18.02)	7.34±0.2 (2.79)	5.91±0.3 (2.51)	21.50±0.8 (67.58)	10.98±0.8 (3.30)	10.03±0.9 (3.28)	8.90±0.6 (2.98)	21.50±0.8 (67.58)	10.78±1.0 (3.27)	8.90±0.6 (2.98)	6.86±0.9 (2.60)
T ₃	NF	20.85±0.7 (27.16)	17.54±0.2 (24.76)	13.17±0.3 (3.61)	12.50±0.7 (28.31)	21.85±0.7 (27.20)	19.56±1.0 (4.41)	16.12±1.0 (4.00)	14.07±0.9 (3.75)	21.85±0.7 (27.20)	18.39±1.1 (4.27)	15.24±1.0 (3.89)	12.11±1.0 (3.46)
T ₄	CF	18.50±0.5 (25.47)	4.5±0.1 (12.30)	4.12±0.2 (2.20)	3.45±0.8 (27.58)	19.50±0.5 (23.47)	5.40±0.6 (2.31)	4.64±0.2 (2.15)	3.67±0.2 (1.91)	10.50±0.5 (23.47)	5.01±0.7 (2.21)	4.14±0.2 (2.15)	2.92±0.2 (1.70)
S.Em±			0.13	0.10	0.13	0.15	0.15	0.15	0.14	0.15	0.14	0.15	0.13
CD @ 5%			0.41	0.31	0.39	0.48	0.41	0.48	0.42	0.48	0.42	0.48	0.41

RPP (Recommended Package of Practice): Mancozeb 75% WP (2g/lit.) **OF** (Organic farming): *Trichoderma harzianum* 10 gm/lit. **NF** (Natural Farming): Sour butter milk (5lit. per 200 lit. of water) **CF** (Chemical farming): Propiconazole 25 EC @ 1ml/l # Days after spray*Pooled of five replications **SEm±**: Standard Error of Mean@ Figures in parentheses indicate square root transformed value.

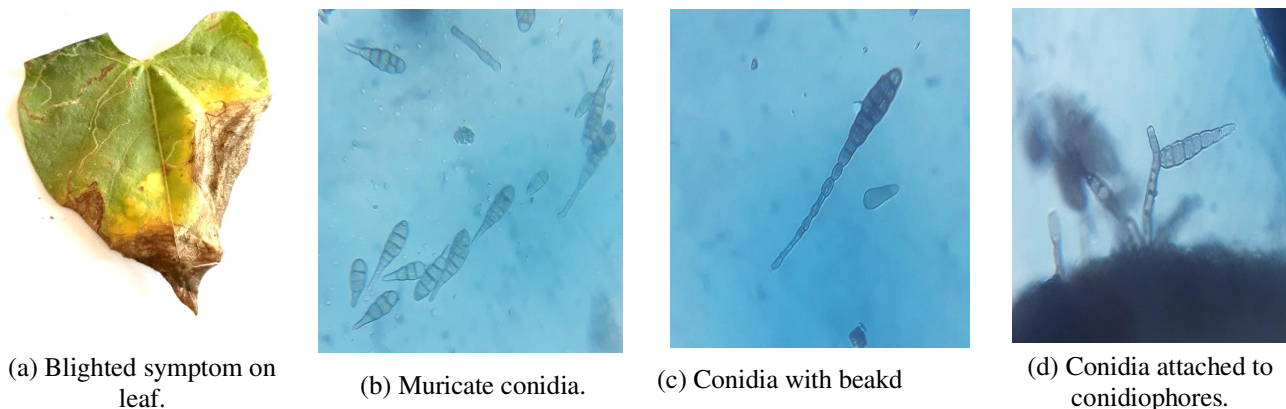


Fig. 1. *Alternaria* leaf blight affected leaf and microscopic images of conidia.

Table 3: Pooled data of different farming practices for management of *Alternaria* leaf blight disease in French bean during 2019-2022 at experimental plot, CoH, Sirsi.

Treatment		Management practices	Per cent Disease Index		
			15 DAS [#]	30 DAS	45 DAS
T ₁	Recommended package of practice	Mancozeb 75% WP (2g/lit.)	8.47±0.24 (13.40)	6.94±0.44 (12.77)	6.26±0.27 (10.67)
T ₂	Organic Farming	<i>Trichoderma harzianum</i> 10 gm/lit.	9.50±0.70 (18.73)	8.75±0.61 (17.45)	7.22±0.46 (14.71)
T ₃	Natural farming	Sour butter milk (5lit. per 200 lit. of water)	18.49±1.15 (25.34)	14.84±0.78 (22.64)	12.89±0.72 (20.42)
T ₄	Chemical farming	Propiconazole 25 EC @ 1ml/l	4.97±0.37 (17.05)	4.30±0.34 (15.21)	3.35±0.53 (14.13)
S.Em±			0.46	0.59	0.50
CD @ 5%			1.51	1.78	1.52

Note: DAS: Days After Spray,

*Figures in parentheses indicate arc sine transformed value

CONCLUSIONS

Among the evaluated management practice, spraying of Propiconazole 25%EC @1ml/l which is followed by Mancozeb 75%WP @2gm/lit. found effective because of specific mode of action by combi/solo fungicides. Foliar application of *Trichoderma harzianum* @10gm/lit. is an ecofriendly and alternative approach to combat disease. Foliar application of sour butter milk found least effective against disease.

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Conflict of Interest. None.

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