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Effect of Integrated Management on Ascochyta Blight and Yield of Pea Crop

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ABSTRACT: Ascochyta blight caused by *Ascochyta pisi* Lib. is an important disease of pea. It is a worldwide disease which is appears on leaves, stems and pods of pea and significant economic yield losses. Pea is annual plants with a life cycle of one year, it is a cool-season crop grown in many parts of the world. The total area, production and productivity of pea in India in 2017-18 was 540.48 thousand hectare, 5422.14 thousand MT/ha and 10.0 MT/ha respectively. In present investigation bioagents, biochemicals and fungicides were tested for management of Ascochyta blight disease of pea under field condition. these bioagents, biochemicals and fungicides were used against Ascochyta blight and yield of pea crop during 2021-22 and 2022-23, significant maximum reduction in disease incidence (11.07%), disease severity (4.80%) and increase yield (24.64 qt/ha.) were recorded with Seed Treatment with Thiram @ 3g/ kg seed + two foliar spray of Propiconazole 25%EC @ 0.1% at 45DAS and 75DAS. This was followed by *Trichoderma harzianum, Trichoderma viride, Pseudomonas fluorescens*, Humic acid, Salicylic acid, Jasmonic acid, Chlorothalonil, Propiconazole and Hexzaconazole treatments that significantly management Whereas, minimum reduced disease incidence (38.21%), disease severity (15.99%) and increase yield (11.59 qt/ha.) was recorded with two foliar spray of Copper oxychloride 50%WP @ 0.25% at 45DAS and 75DAS compared to untreated (61.11%) disease incidence, (32.50%) disease severity and (9.27 qt/ha.) increase yield were found effective for the control of disease and gave higher yield.

Keywords: Ascochyta blight, bioagents, biochemicals, Humic acid, Salicylic acid Jasmonic acid and fungicides.

INTRODUCTION

Pulses are an essential component of Indian agriculture. As a key source of dietary protein, they have played an important role in agricultural productivity throughout the history of mankind. Because pulses are high in protein and numerous necessary amino acids, they play an important function in supplementing the cereal-rich diets of our country's primarily vegetarian population. The ease with which they fit into crop rotations and crop mixtures, their long recognized property of improving soil fertility, their potential to yield and finally the high consumer demand for pulses have all contributed to their popularity among Indian farmers. Pea is grown in Uttar Pradesh (U.P.) on an area of 307.0 thousand hectares with a production of 459.0 thousand tonnes with productivity 1495 kg / ha (Anonymous, 2013). The major pulse producing states are MP (24%), UP (16%), Maharashtra (14 %), AP (10 %) and Karnataka (7 %), Rajasthan (6 %), which together for about 77 per cent of the total production (Reddy *et al.*, 2013). The total area, production and productivity of pea in India in 2017-18 was 540.48 thousand hectare, 5422.14 thousand MT/ha and 10.0 MT/ha respectively (Anonymous, 2018). In spite of that, this seemingly high level of production can provide only 208 grams of vegetables per capita

(Sharma, 2003), as against the suggested dietary intake of 275g and 250g per capita per day for adult male and female, respectively for undertaking moderate work (Swaminathan, 2002). *Ascochyta pisi* (teleomorph: *Didymella pisi*), *Ascochyta pinodes* (teleomorph: *Mycosphaerella pinodes*), and *Phoma medicaginis* var. *pinodella*, formerly known as *Ascochyta pinodella*. This extremely effective group of viruses reproduces heterothallically on infested leftovers, producing airborne ascospores that can travel great distances. Splash-borne asexual conidia (pycnidiospores), which are capable of travelling short distances, enable rapid polycyclic spread within crops. On stems, leaves, and pods, purplish black to brown patches or lesions may appear as a sign of pea disease. On these lesions, black spore-producing structures might develop. Sunken pod lesions are possible. Lower leaves, stems, and tendrils under the plant canopy, where circumstances are more humid, are the first parts of the plant to show early symptoms (purple-brown irregular flecks). Davidson and Kimber (2007) reported that *Ascochyta pisi* causes significant yield loss in pulse crops worldwide. Integrated disease management is essential to take advantage of cultivars with partial resistance to this disease. The most effective practices, established by decades of research, use a combination of disease-free seed, destruction or avoidance of inoculum sources, manipulation of sowing dates, seed and foliar fungicides, and cultivars with improved resistance. An understanding of the pathosystems and the inter-relationship between host, pathogen and the environment is essential to be able to make correct decisions for disease control without compromising the agronomic or economic ideal. For individual pathosystems, some components of the integrated management principles may need to be given greater consideration than others. For instance, destruction of infested residue may be incompatible with no or minimum tillage practices, or rotation intervals may need to be extended in environments that slow the speed of residue decomposition. For ascochyta-susceptible chickpeas the use of disease-free seed, or seed treatments, is crucial as seed-borne infection is highly effective as primary inoculum and epidemics develop rapidly from foci in favourable conditions. Implemented fungicide strategies differ according to cultivar resistance and the control efficacy of fungicides, and the effectiveness of genetic resistance varies according to seasonal conditions. Studies are being undertaken to develop advanced decision support tools to assist growers in making more informed decisions regarding fungicide and agronomic practices for disease control. Crop rotation, adjusting sowing schedules, using disease-free seed, using seed treatment with biocontrol agents and foliar fungicides, Mishra *et al.* (2007) reported that *Trichoderma* is one of the most effective and attractive biological control agents (BCAs) as well as an alternative to conventional fungicides. These *Trichoderma* based BCAs are economically viable and environment-friendly and represent the most competent means to sustain the existing level of agricultural production system. For the management of insect pests and diseases, chemical pesticides are extensively employed across the world. However, the global risk associated with the environmental pollution and health hazards posing toxicity to man, plants, domestic animals, and wildlife render these chemical-based interventions ecologically unacceptable.

MATERIALS AND METHODS

The field experiment were conducted during Rabi season of 2021-2022 and 2022-2023 at Crop Research Center, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (Uttar Pradesh). The field experiment is conducted in randomized block design (RBD) with three replication and Plot size 4 × 3 m^2 of following treatments least in Table 1 and observation was recorded percent disease incidence, percent disease severity and seed yield per quintal per hectare.

Table 1: Treatment Details.

Treatment	Treatment details
T_1	Seed treatment with *Trichoderma harzianum* (10^7 Cfu/g @ 10g/ kg seed) + Two foliar spray of Chlorothalonil 75% WP @ 0.25% at 45DAS and 75DAS.
T_2	Seed treatment with *Pseudomonas fluorescens* (10^7 Cfu/g @ 10g/ kg seed) + Two foliar spray of Copper oxychloride 50% WP @ 0.25% at 45DAS and 75DAS.
T_3	Seed treatment with *Trichoderma viride* (10^7 Cfu/g @ 10g/ kg seed) + Two foliar spray of Hexzaconazole 5%SC @ 0.1% at 45DAS and 75DAS.
T_4	Seed treatment with Thiram @ 3g/ kg seed + Two foliar spray of Propiconazole 25%EC @ 0.1% at 45DAS and 75DAS.
T_5	Seed treatment with Humic acid @ 3ml/ kg seed + Two foliar spray of Humic acid @ 3ml/lit. water at 45DAS and 75DAS.
T_6	Seed treatment with Salicylic acid @100mg/lit. + Two foliar spray of Salicylic acid @ 0.01% at 45DAS and 75DAS.
T_7	Seed treatment with Jasmonic acid @100mg/lit. + Two foliar spray of Jasmonic acid @ 0.01% at 45DAS and 75DAS.
T_8	Two foliar spray of Chlorothalonil 75% WP @ 0.25% at 45DAS and 75DAS.
T_9	Two foliar spray of Propiconazole 25% EC @ 0.1% at 45DAS and 75DAS.
T_{10}	Two foliar spray of Hexzaconazole 5% SC @ 0.1% at 45DAS and 75DAS.
T_{11}	Two foliar spray of Copper oxychloride 50%WP @ 0.25% at 45DAS and 75DAS.
T_{12}	Control

A. Disease assessment

After harvest numbers of pods having ascochyta blight were recorded and percentage of infected pod was calculated for each plot. The percent disease incidence was calculated by using the formula devised by Mathur *et al*. (1972).

The per cent disease severity was calculated by using the formula devised by Mathur *et al*. (1972)

$$\text{Disease incidence (\%)} = \frac{\text{No. of pea pods exhibiting ascochyta blight}}{\text{Total No.of pea pods observed}} \times 100$$

$$\text{Disease severity (\%)} = \frac{\text{Sum of numerical disease ratings}}{\text{No.of plants observed} \times \text{Maximum disease rating}} \times 100$$

B. Yield

Pea yield was recorded for each plot at harvesting in terms of kg/plot which was converted to q/ha.

C. Statistical analysis

The data were analyzed using Analysis of Variance (ANOVA) and treatment means were differentiated using Fischer's randomized block design (RBD) in field experiments and the analyses of variance for the design of the experiment were done by the OP Stat computer software.

RESULTS AND DISCUSSION

The using bio-agents, biochemical and fungicides of different treatment combinations significantly integrated management on Ascochyta blight and seed yield of pea *viz*; disease incidence, disease severity and yield in comparison to un-treated control/check. Pooled data presented in Table 2 regarding integrated management on Ascochyta blight and seed yield of pea crop during 2021-22 and 2022-23, significant maximum reduced in disease incidence (11.07%), disease severity (4.80%) and increase yield (24.64 qt/ha.) was recorded with T_4 = Seed Treatment with Thiram @ 3g/ kg seed + Two Foliar Spray of Propiconazole 25%EC @ 0.1% at 45DAS and 75DAS. This was followed by disease incidence (14.22%), disease severity (7.12%) and increase yield (23.42 qt/ha.) was recorded with T_1 = Seed Treatment with *Trichoderma harzianum* (10^7 Cfu/g @ 10g/ kg seed) + Two Foliar Spray of Chlorothalonil 75%WP @ 0.25% at 45DAS and 75DAS, disease incidence (16.50%), disease severity (5.46%) and increase yield (21.12 qt/ha.) was recorded with T_3 = Seed Treatment with *Trichoderma viride* (10^7 Cfu/g @ 10g/ kg seed) + Two Foliar Spray of Hexzaconazole 5%SC @ 0.1% at 45DAS and 75DAS, disease incidence (18.70%), disease severity (7.21%) and increase yield (20.09 qt/ha.) was recorded with T_2 = Seed Treatment with *Pseudomonas fluorescens* (10^7Cfu/g @ 10g/ kg seed) + Two Foliar Spray of Copper oxychloride 50%WP @ 0.25% at 45DAS and 75DAS, disease incidence (20.56%), disease severity (7.75%) and increase yield (19.55 qt/ha.) was recorded with T_6 = Seed Treatment with Salicylic acid @100mg/lit. + Two Foliar Spray of Salicylic acid @ 0.01% at 45DAS and 75DAS, disease incidence (21.86%), disease severity (8.36%) and increase yield (19.22 qt/ha.) was recorded with T_7 = Seed Treatment with Jasmonic acid @100mg/lit. + Two Foliar Spray of Jasmonic acid @ 0.01% at 45DAS and 75DAS, disease incidence (26.83%), disease severity (10.54%) and increase yield (18.15 qt/ha.) was recorded with T_5 = Seed Treatment with Humic acid @ 3ml/ kg seed + Two Foliar Spray of Humic acid @ 3ml/lit. water at 45DAS and 75DAS, disease incidence (33.17%), disease severity (11.67%) and increase yield (14.05 qt/ha.) was recorded with T_9 = Two Foliar Spray of Propiconazole 25%EC @ 0.1% at 45DAS and 75DAS, disease incidence (34.78%), disease severity (12.54%) and increase yield (15.10 qt/ha.) was recorded with T_8 = Two Foliar Spray of Chlorothalonil 75%WP @ 0.25% at 45DAS and 75DAS, disease incidence (37.39%), disease severity (14.71%) and increase yield (12.82 qt/ha.) was recorded with T_{10} = Two Foliar Spray of Hexzaconazole 5% SC @ 0.1% at 45DAS and 75DAS Whereas, minimum reduced disease incidence (38.21%), disease severity (15.99%) and increase yield (11.59 qt/ha.) was recorded with T_{11} = Two Foliar Spray of Copper oxychloride 50% WP @ 0.25% at 45DAS and 75DAS compared to control disease incidence (61.11%), disease severity (32.50%) and increase yield (9.27 qt/ha.) were found effective for the control of disease and gave higher yield significantly and discussion following review with (Benzohra *et al.*, 2020) demonstrated a significant percentage reduction in the severity of ascochyta blight varied between 20 and 80% in an in vivo test of chemical control for Ascochyta Blight occurrence via detached leaves. We found that azoxystrobin, a systemic fungicide, can lessen the severity of ascochyta blight by between 71 and 80%, while maneb and chlorothalonil, two contact fungicides, had mycelia growth inhibition rates that were close to 50% (between 20 and 47%). These findings showed that ascochyta blight disease in the susceptible cultivars (ILC1929, ILC263 and ILC484) has been significantly suppressed by systemic fungicides such azoxystrobin. According to Devia *et al.* (2020), IR (Induced resistance) is a security setup in the interior of the plants to counterattack bacterial, viral, and fungal diseases as well as any pests. After the suspicion surfaced, the system stepped up its defence against the assault. In this study, the effectiveness of eight IR compounds and the conventional fungicide hexaconazole against French bean rust was assessed in relation to changes in the biochemical components present in the plant under pot conditions. When plants were challenge inoculated after 20 days of IR chemical treatment, the least severe disease severity was observed. In comparison to control plants, plants sprayed with KH_2PO_4 had the lowest disease severity (8.50%). Benzothiadiazole and potassium dihydrogen phosphate sprays were shown to be slightly less efficient than the typical fungicide hexaconazole in lowering disease severity to 30.71%

and 41.23%, respectively, under field settings. Warkentin *et al.* (1995). Field pea productivity and seed weight increased, and Ascochyta blight was less severe thanks to the use of chlorothalonil and benomyl. A mean yield increase of 33% over the untreated plants was seen as a result of the threefold treatment of chlorothalonil. Panicker and Ramraj (2010) investigated various chemicals for the control of the disease and found that carbendazim was the most effective therapy, reducing the percent disease index to 21.3 after seed treatment with thiram at 2 g/kg seed and three sprays of chlorothalonil at 0.15%. Manzoor (2013) revealed that the disease was prevalent in all the pea growing areas of Kashmir valley surveyed in varying proportions. The per cent disease incidence and severity varied from 32.16 to 72.16 per cent and 9.65 to 31.11 per cent, respectively. Highest mean disease incidence (58.88%) and severity (20.14%) was recorded in district Pulwama whereas lowest mean disease incidence (45.15%) and severity (14.19%) was recorded from district Baramulla. Two chemicals *viz*., carbendazim 50 WP and chlorothalonil 75 WP and bioagents viz., *Trichoderma harzianum* and *Pseudomonas fluorescens* were used individually and in different combinations. All the treatments were found significantly effective in reducing the Ascochyta blight of pea over control. Chaudhary and Naimuddin (2000) reported that fungicides effective against *Ascochyta* spp. are carbendazim, chlorothalonil and benomyl among systemic fungicides were effectively in reducing the severity of Ascochyta blight and increasing the yield andseed weight of field pea. Xue *et al.* (2003) evaluated the efficacy of chlorothalonil in controlling *Mycosphaerella* blight of field pea on 10 different cultivars for three consecutive years and observed that Chlorothalonil treatment provide a greater benefit in years when disease pressure and yield potential are high. Further, the fungicide increased yield by 6.4 per cent, and total seed weight by 0.9-5.1 per cent. Saikia *et al.* (2003) selected isolates of *Pseudomonas fluorescens* (*Pf*1–94, *Pf*4–92, *Pf*12–94, *Pf*151–94 and *Pf*179–94) and chemical resistance inducers (salicylic acid, acetylsalicylic acid, DL norvaline, indole-3-carbinol and lichenan) were examined for growth promotion and induced systemic resistance against *Fusarium* wilt of chickpea. A marked increase in shoot and root length was observed in *P. fluorescens* treated plants. The isolates of *P. fluorescens* systemically induced resistance against *Fusarium* wilt of chickpea caused by *Fusarium. Oxysporum* f.sp. *ciceri* (*Foc*Rs1), and significantly (P = 0.05) reduced the wilt disease by 26–50% as compared to control. Among chemical inducers, SA showed the highest protection of chickpea seedlings against wilting. Fifty two- to 64% reduction of wilting was observed in soil treated with isolate *Pf*4–92 along with chemical inducers. Wani *et al.* (2016) found that Pollution and climate change degrade plant health. Plant stress can be decreased by application of salicylic acid a hormone involved in plant signaling. Salicylic acid indeed initiates pathogenesis-related gene expression and synthesis of defensive compounds involved in local resistance and systemic acquired resistance. Salicylic acid may thus be used against pathogen virulence, heavy metal stresses, salt stress, and toxicities of other elements. Chen *et al*. (2009) found that salicylic acid improves photosynthesis, growth, and various other physiological and biochemical characteristics in stressed plants and reduction of plant diseases.

Table 2: Effect of integrated management on Ascochyta blight and yield of pea crop during 2021-22 and 2022-23.

Treatment No.	First year			Second year			Pooled		
	% Disease Incidence	% Disease Severity	Yield/qtl	% Disease Incidence	% Disease Incidence	Yield/qt	% Disease Incidence	% Disease Severity	Yield/qt
T_1	14.44	7.73	23.33	14.00	6.50	23.50	14.22	7.12	23.42
T_2	18.89	7.32	20.00	18.50	7.10	20.17	18.70	7.21	20.09
T_3	16.66	5.61	21.07	16.33	5.30	21.17	16.50	5.46	21.12
T_4	11.11	5.10	24.50	11.03	4.50	24.77	11.07	4.80	24.64
T_5	26.66	11.07	18.00	27.00	10.00	18.30	26.83	10.54	18.15
T_6	21.11	8.00	19.50	20.00	7.50	19.60	20.56	7.75	19.55
T_7	22.22	8.71	19.10	21.50	8.00	19.33	21.86	8.36	19.22
T_8	34.55	13.07	15.00	35.00	12.00	15.20	34.78	12.54	15.10
T_9	33.33	12.33	14.00	33.00	11.00	14.10	33.17	11.67	14.05
T_{10}	37.77	15.12	12.77	37.00	14.30	12.87	37.39	14.71	12.82
T_{11}	38.89	16.47	11.50	37.53	15.50	11.67	38.21	15.99	11.59
T_{12}	62.22	33.66	9.20	60.00	31.33	9.33	61.11	32.50	9.27
C.D. at 5%	4.45	0.98	1.70	3.26	1.32	1.72	3.85	1.15	1.71
SE(m) +	1.51	0.33	0.57	1.10	0.44	0.58	1.30	0.38	0.57
C.V.	9.29	4.84	5.76	6.95	7.01	5.76	8.12	5.92	5.76

CONCLUSIONS

In field experiment, thiram @ 3g as seed treatment was found most effective for reduction of disease incidence, disease severity and enhance the yield and quality of pea crop thereby suggest that farmers may use thiram @ 3g as seed treatment for the management of ascochyta blight disease and enhance the yield and quality of pea crop while alternative of chemical and biochemicals farmers may also use *Trichoderma harzianum, Trichoderma viride, Pseudomonas fluorescens*, Humic acid, Salicylic acid, Jasmonic acid, Chlorothalonil, Propiconazole and Hexzaconazole treatments that significantly management.

FUTURE SCOPE

Thereby suggest that farmers may use thiram as seed treatment for the management of ascochyta blight disease and enhance the yield and quality of pea crop while alternative of chemical and biochemicals farmers may also use *Trichoderma harzianum, Trichoderma viride, Pseudomonas fluorescens*, Humic acid, Salicylic acid, Jasmonic acid, Chlorothalonil, Propiconazole and Hexzaconazole.

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