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Evaluation of the growth parameters with respect to Bio control agents with chemical fungicides against *Cercospora* leaf spot of Okra (*Abelmoschus esculentus* L.) Moench

. ABSTRACT

Okra (*Abelmoschus esculentus* L.) is one of the fore most vegetable crop grown during *kharif* as well as summer seasons. *Cercospora* leaf spot incited by *Cercospora* spp. is one of the emerging disease in all regions wherever okra is grown. *C. abelmoschi* causes sooty black, angular spots and cause severe defoliation common during humid seasons. An experiment was conducted to evaluate the efficacy of bioagents and chemicals viz., T0 – Untreated control, T1 Mancozeb (1%) + *Trichoderma*(4%) , T2 - Mancozeb (1%) + *Pseudomonas*(4%) , T3 Mancozeb (1%) + *Bacillus subtilis*(4%), T4 - Mancozeb (1%) + *Trichoderma*(2%) + *Pseudomonas*(2%) , T5 - Mancozeb (1%) + *Pseudomonas*(2%) + *Bacillus subtilis*(2%), T6 Mancozeb (1%) + *Bacillus subtilis*(2%) + *Trichoderma*(2%), T7 - Mancozeb (1%) against *Cercospora* leaf spot of okra. Studies revealed that minimum disease intensity , Maximum plant height , maximum no. of branches per plant and Maximum no. of fruits was observed in T4 - Mancozeb (1%) + *Trichoderma*(2%) + *Pseudomonas*(2%) and is hereby considered as the best treatment.

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Keywords: Mancozeb , *Trichoderma* , *Pseudomonas*, *Bacillus*.

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17 1. INTRODUCTION

18

19 **Okra (*Abelmoschus esculentus* L.)** Moench is one of the most widely known species of
20 the family Malvaceae and an economically important vegetable crop grown in tropical
21 climate of temperature range between 25^o to 35^oc. The name "Okra" derives from one of
22 Niger-Congogroup of languages. "Okra" originated in Ethiopia and was then propagated
23 in North Africa, In India okra is grown in sub tropical areas and it is commonly known as
24 Bhendi

25

. Some studies are being developed targeting okra extract as remedy to
26 manage diabetes. Its ripe seeds are roasted, ground and used as a substitute for
27 coffee in some countries. Mature pods and stems containing crude fibre are used in
28 the paper industry. Okra seeds are a potential source of oil, which consists of linoleic
29 acid up to 47.4% and polyunsaturated fatty acid essential for human nutrition. **(Singh**
30 **et al., 2014).**

31

Okra contains Potassium, Sodium, Magnesium and Calcium as principal
32 elements in pods, which contains 17% seeds. Presence of Iron, Zinc, Manganese and
33 Nickel also has been reported **(Moyin-Jesu, 2007)**. Fresh pods are low in calories
34 (20/100 g), practically no fat, rich in fiber, and with several valuable nutrients. Okra
35 seed is mainly composed of oligomeric catechins (2.5 mg g⁻¹ of seeds), while the
36 mesocarp is mainly composed of hydroxycinnamic (0.2 mg g⁻¹) and quercetin
37 derivatives (0.3 mg g⁻¹). Pods are rich in phenolic compounds with important biological
38 properties like quercetin derivatives, catechin oligomers and hydroxycinnamic
39 derivatives **(Arapitsas, 2008)**.

40

Okra plant also contains many medicinal properties with it. But before using, it
41 is very necessary to seek advice from a professional. The mucilage can be used as
42 plasma replacement, helpful in washing away toxic substances from the body and
43 have strongly demulcent action **(Gemedé et al., 2015)**. In the treatment of syphilis
44 infusion of root is used. In Nepal the juice of root is used in the boils, wound and cuts.
45 It is used in the medication of catarrhal infections, dysuria and gonorrhoea. Other than
46 this fibre present in okra has property of controlling blood sugar level in blood. Okra
47 has nutrient that insure proper functioning of intestine. It is also effective in ulcer and
48 joint healthiness. Due to its alkaline nature, it also gours the mucous membrane in
49 the digestive system. Useful in curing of pulmonary inflammation, bowel irritation and
50 sore throat **(Kumar et al., 2013)**. Its fruit can be also be used for the control of goitre
51 due to high iodine content in it .

52

Diseases play a vital role in yield losses of the crop. Among them, fungi are
53 one of the most important and prevalent pathogens which attack the crops from
54 seedling to harvesting stage. Some of the fungal diseases that attack are *Cercospora*

55 leaf spot (*Cercospora abelmoschi*), damping-off (*Pythium sp. and Rhizoctonia sp.*),
56 powdery mildew
57 (*Oidium sp.*), southern blight (*Sclerotium rolfsii*), verticillium wilt (*Verticillium albo-*
58 *atrum*) and *alternaria leaf spot* (Raid and Palmateer, 2006).

59 Among the fungal diseases *Cercospora* leaf spot of bhendi incited by
60 *Cercospora* is one of the most economically important in all regions wherever bhendi is
61 grown. In India, two species of *Cercospora* produce leaf spots on bhendi. *C.*
62 *malayensis* causes brown, irregular spots and *C. abelmoschi* causes sooty black,
63 angular spots. Both the leaf spots cause severe defoliation and are common during
64 humid seasons. Now a days, this disease incited by *C. abelmoschi* becomes more
65 severe in southern transition zone of Karnataka. Initially the disease symptoms
66 observed on the lower surface of the leaves as in distinct spots in the form of
67 olivaceous specks. Later on, light brown to grey mouldy growth of the fungus covered the
68 entire lower surface. The infected leaves ultimately dry and defoliate. The disease
69 progress upward from lower leaves and infects stem and fruits and produces similar
70 symptoms. (Naik et al., 2017).

71 *Cercospora* produce a perylene quinone toxin called cercosporin which is non- selective,
72 affecting bacteria and fungi unless these produce protective antioxidants such as
73 carotenoids. Morphology of the pathogen of genus *Cercospora* was first described by
74 Frensius (1863), Etymologically the generic name means a fungus has obclavate (tail
75 shaped)spores. Sporulation occurs at temperature range 8-24 °C, where mature spores
76 sporulate after 14to 24 hours.

77 For the management of *Cercospora* leaf spot of okra from many years, many
78 have beenrelied on chemicals and this resulted in many undesirable problems. Now a
79 day's tremendous use of chemicals in agriculture has resulted in growing concern of
80 both public health and environment hazards thus, emphasis is now on judicious use of
81 bio-agents, botanicals and organics for management of the plant diseases which is less
82 costly, nontoxic and doesn't affectpublic health and environment. Fungicides are also
83 effective in managing this disease as suchtheir use in the management strategy can
84 not be ruled out but their indiscriminate use should be avoided. There is need to
85 incorporate alternative control components that are effective in field. Considering the
86 above-mentioned facts, a study was conducted, entitled, , "**Efficacy of bio control**
87 **agents with chemical fungicides against *Cercospora* leaf spot of Okra**
88 **(*Abelmoschus esculentus* L.) Moench**" with the following objectives :-

89 1. To evaluate the effect of bioagents on *Cercospora* disease
90 intensity in okra.

91 2. MATERIAL AND METHODS

92 The experiment was conducted at the research plot of the Department of Plant

93 Pathology and Central Research Field, Sam Higginbottom University of
 94 Agriculture Technology And Sciences, Prayagraj during the *Kharif* season 2022.
 95 The selected site was uniform, cultivable with typical sandy loam soil having
 96 good drainage.

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| S. No | Treatments | Treatment Details |
|-------|------------|---|
| 1. | T0 | Control |
| 2. | T1 | Mancozeb (1%) + <i>Trichoderma harzianum</i> (4%) |
| 3. | T2 | Mancozeb (1%) + <i>Pseudomonas fluorescens</i> (4%) |
| 4. | T3 | Mancozeb (1%) + <i>Bacillus subtilis</i> (4%) |
| 5. | T4 | Mancozeb (1%) + <i>Trichoderma harzianum</i> (2%) + <i>Pseudomonas fluorescens</i> (2%) |
| 6. | T5 | Mancozeb (1%) + <i>Pseudomonas fluorescens</i> (2%) + <i>Bacillus subtilis</i> (2%) |
| 7. | T6 | Mancozeb (1%) + <i>Bacillus subtilis</i> (2%) + <i>Trichoderma harzianum</i> (2%) |
| 8. | T7 | Mancozeb (1%) |

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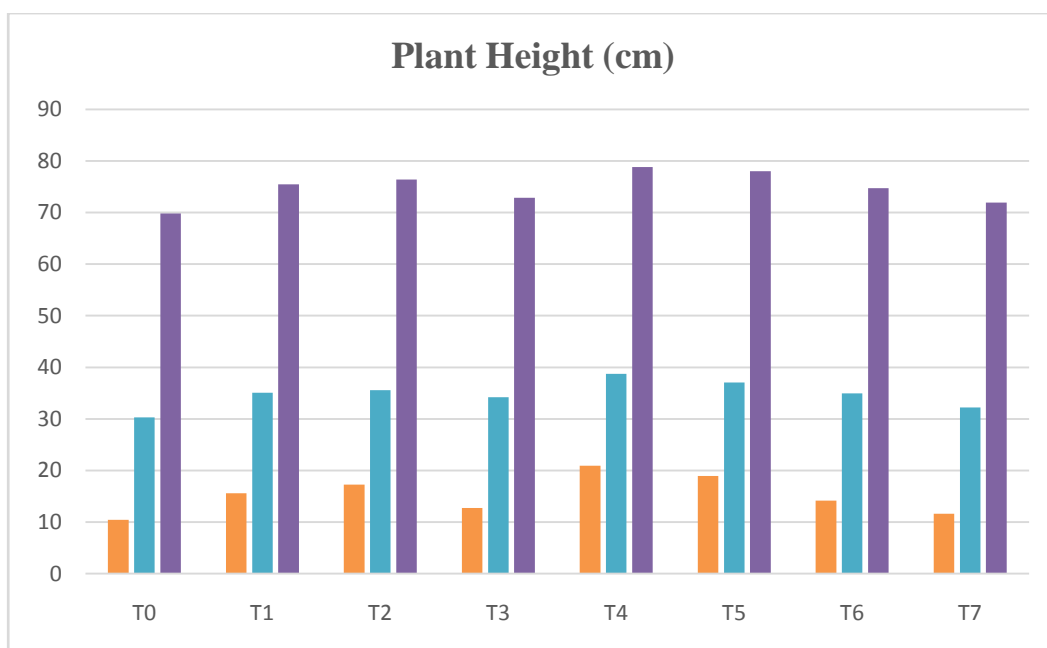
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106 **Effect of treatments on Plant height of *Cercospora* leaf spot of okra at 30, 60 and 90**
 107 **DAS**

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| Tr.no | Treatment | Plant height (cm) | | |
|-------|---|--------------------|--------------------|--------------------|
| | | 30 DAS | 60 DAS | 90 DAS |
| T0 | Control | 10.41 ^h | 30.26 ^e | 69.81 ^g |
| T1 | Mancozeb (1%) + <i>Trichoderma harzianum</i> (4%) | 15.58 ^d | 35.04 ^c | 75.46 ^d |
| T2 | Mancozeb (1%) + <i>Pseudomonas fluorescens</i> (4%) | 17.24 ^c | 35.57 ^c | 76.38 ^d |
| T3 | Mancozeb (1%) + <i>Bacillus subtilis</i> (4%) | 12.75 ^f | 34.22 ^c | 72.89 ^e |
| T4 | Mancozeb (1%) + <i>Trichoderma harzianum</i> (2%) + <i>Pseudomonas fluorescens</i> (2%) | 20.89 ^a | 38.70 ^a | 78.85 ^a |
| T5 | Mancozeb (1%) + <i>Pseudomonas fluorescens</i> (2%) + <i>Bacillus subtilis</i> (2%) | 18.96 ^b | 37.04 ^b | 78.04 ^b |
| T6 | Mancozeb (1%) + <i>Bacillus subtilis</i> (2%) + <i>Trichoderma harzianum</i> (2%) | 14.16 ^e | 34.93 ^c | 74.72 ^c |
| T7 | Mancozeb (1%) | 11.58 ^g | 32.22 ^d | 71.92 ^f |
| | C.D (5%) | 0.86 | 1.46 | 0.79 |

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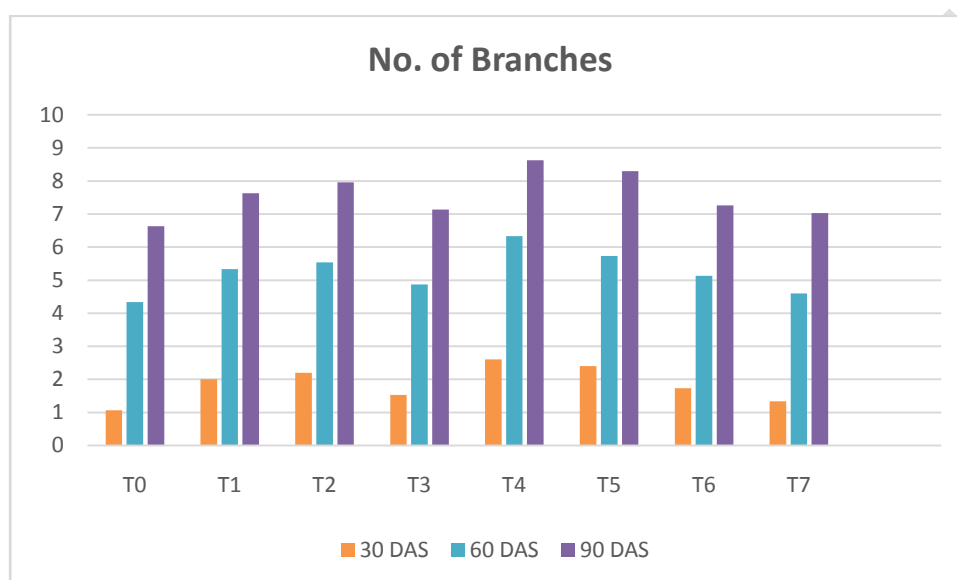
112 Effect of treatments on No. of Branches of *Cercospora* leaf spot of okra at 30, 60
 113 and 90 DAS

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| Tr.no | Treatment | No. of Branches | | |
|-------|---|--------------------|---------------------|-------------------|
| | | 30 DAS | 60 DAS | 90 DAS |
| T0 | Control | 1.067 ^h | 4.333 ^g | 6.63 ^f |
| T1 | Mancozeb (1%) + <i>Trichoderma harzianum</i> (4%) | 2.000 ^d | 5.333 ^{cd} | 7.63 ^d |
| T2 | Mancozeb (1%) + <i>Pseudomonas fluorescens</i> (4%) | 2.200 ^c | 5.533 ^b | 7.96 ^c |
| T3 | Mancozeb (1%) + <i>Bacillus subtilis</i> (4%) | 1.533 ^f | 4.867 ^e | 7.13 ^e |
| T4 | Mancozeb (1%) + <i>Trichoderma harzianum</i> (2%) + <i>Pseudomonas fluorescens</i> (2%) | 2.600 ^a | 6.333 ^a | 8.63 ^a |
| T5 | Mancozeb (1%) + <i>Pseudomonas fluorescens</i> (2%) + <i>Bacillus subtilis</i> (2%) | 2.400 ^b | 5.733 ^b | 8.30 ^b |

| | | | | |
|----------|---|--------------------|--------------------|-------------------|
| T6 | Mancozeb (1%) + Bacillus subtilis(2%) + Trichoderma harzianum (2%) | 1.733 ^e | 5.133 ^d | 7.26 ^e |
| T7 | Mancozeb (1%) | 1.333 ^g | 4.600 ^f | 7.03 ^e |
| C.D (5%) | | 0.86 | 0.118 | 0.27 |

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118 **Effect of treatments on No. of Fruits of Cercospora leaf spot of okra at 60,75 and**
 119 **90 DAS**

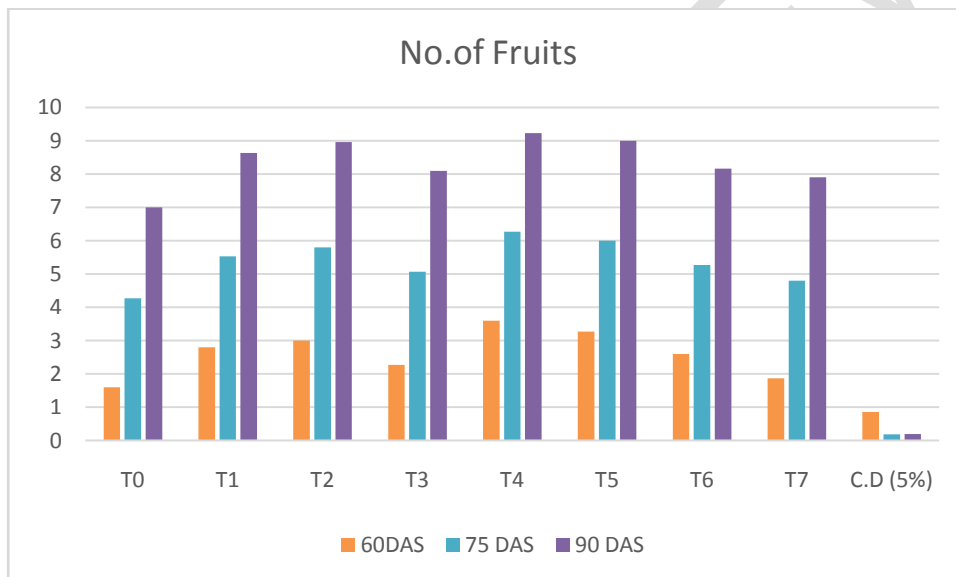
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| Tr.no | Treatment | No. of fruits | | |
|-------|---|--------------------|--------------------|-------------------|
| | | 60DAS | 75 DAS | 90 DAS |
| T0 | Control | 1.600 ^h | 4.267 ^h | 7.00 ^f |
| T1 | Mancozeb (1%) + Trichoderma harzianum (4%) | 2.800 ^d | 5.533 ^d | 8.63 ^d |
| T2 | Mancozeb (1%) + Pseudomonas fluorescens (4%) | 3.000 ^c | 5.800 ^c | 8.96 ^b |
| T3 | Mancozeb (1%) + Bacillus subtilis(4%) | 2.267 ^f | 5.067 ^f | 8.10 ^c |
| T4 | Mancozeb (1%) + Trichoderma harzianum (2%) + Pseudomonas | 3.600 ^a | 6.267 ^a | 9.23 ^a |

| | <i>fluorescens</i> (2%) | | | |
|-----------|---|--------------------|--------------------|-------------------|
| T5 | Mancozeb (1%) + <i>Pseudomonas fluorescens</i> (2%) + <i>Bacillus subtilis</i>(2%) | 3.267 ^b | 6.000 ^b | 9.00 ^b |
| T6 | Mancozeb (1%) + <i>Bacillus subtilis</i>(2%) + <i>Trichoderma harzianum</i> (2%) | 2.600 ^e | 5.267 ^e | 8.16 ^d |
| T7 | Mancozeb (1%) | 1.867 ^g | 4.800 ^g | 7.90 ^e |
| C.D (5%) | | 0.86 | 0.181 | 0.19 |

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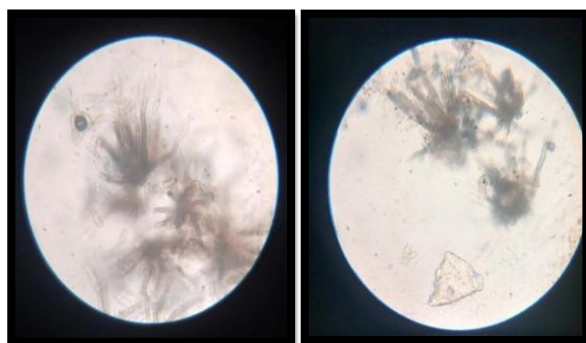
Overview of Spraying



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Overview of Disease Infested Leaves



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OVERVIEW OF MICROSCOPIC VIEW OF *Cercospora sp.*

133

RESULTS :-

134 **Effect of bioagents and chemical fungicide on plant height (cm) of okra at 30,**
 135 **60 and 90 DAS**

136 **4.1 Plant height (cm):**

137 **4.1.1 Plant height (cm) at 30 DAS**

138 The data presented in table 4.1 and depicted in figure 4.1 reveals that
 139 maximum plant height (cm) of okra at 30 DAS was recorded in T4 - Mancozeb (1%)
 140 + *Trichoderma*(2%) + *Pseudomonas*(2%) (20.89 cm) followed by T5 - Mancozeb
 141 (1%) + *Pseudomonas*(2%) + *Bacillus subtilis*(2%) (18.96 cm) and T2 - Mancozeb
 142 (1%) + *Pseudomonas*(4%) (17.24 cm) followed by T₁ Mancozeb (1%) +
 143 *Trichoderma*(4%) (15.58) , T₆ Mancozeb (1%) + *Bacillus subtilis*(2%) +
 144 *Trichoderma*(2%)(14.16), T₃ Mancozeb (1%) + *Bacillus subtilis*(4%) (12.75) as
 145 compared to T7 - Mancozeb (1%) (11.58cm) and T0 – untreated control- (10.41cm).
 146 All the treatments were significant over untreated control.

147 **4.1.2 Plant height (cm) at 60 DAS**

148 The data presented in table 4.1 and depicted in figure 4.1 reveals that
 149 maximum plant height (cm) of okra at 60 DAS was recorded in T4 - Mancozeb (1%)
 150 + *Trichoderma*(2%) + *Pseudomonas*(2%) (38.70 cm) followed by T5 - Mancozeb
 151 (1%) + *Pseudomonas*(2%) + *Bacillus subtilis*(2%) (37.04 cm) and T2 - Mancozeb
 152 (1%) + *Pseudomonas*(4%) (35.57 cm) followed by T₁ Mancozeb (1%) +
 153 *Trichoderma*(4%) (35.04 cm) , T₆ Mancozeb (1%) + *Bacillus subtilis*(2%) +
 154 *Trichoderma*((2%) 34.93 cm), T₃

155

156 Mancozeb (1%) + *Bacillus subtilis*(4%) (34.22 cm) as compared to T7 - Mancozeb
 157 (1%) (32.22 cm) and T0 – untreated control- (30.26 cm). All the treatments were

158 significant over untreated control , Among the treatments (T₃ and T₄) , (T₄ and T₂) ,
159 (T₂ and T₇) were statistically non significant to each other .

160 **4.1.3 Plant height (cm) at 90 DAS**

161 The data presented in table 4.1 and depicted in figure 4.1 reveals that
162 maximum plant height (cm) of okra at 90 DAS was recorded in T₄ - Mancozeb (1%)
163 + *Trichoderma*(2%) + *Pseudomonas*(2%) (78.85 cm) followed by T₅ - Mancozeb
164 (1%) + *Pseudomonas*(2%) + *Bacillus subtilis*(2%) (78.04 cm) and T₂ - Mancozeb
165 (1%) + *Pseudomonas*(4%) (76.38 cm) followed by T₁ Mancozeb (1%) +
166 *Trichoderma*(4%) (75.46 cm) , T₆ Mancozeb (1%) + *Bacillus subtilis*(4%) +
167 *Trichoderma*(4%)(74.72 cm), T₃ Mancozeb (1%) + *Bacillus subtilis*(4%) (72.89 cm) as
168 compared to T₇ - Mancozeb (1%) (71.92 cm) and T₀ – untreated control- (69.81 cm
169). All the treatments were significant over untreated control , Among the treatments
170 (T₃ and T₂) were statistically non significant to each other

171 **Effect of bioagents and chemical fungicide on No. of Branches of okra at 30,** 172 **60 and 90 DAS**

173

174 **4.2 No. of Branches:**

175 **4.2.1 No. of Branches at 30 DAS**

176 The data presented in table 4.2 and depicted in figure 4.2 reveals that
177 maximum plant height (cm) of okra at 30 DAS was recorded in T₄ - Mancozeb (1%)
178 + *Trichoderma*(2%) + *Pseudomonas*(2%) (2.60) followedby T₅ - Mancozeb (1%) +
179 *Pseudomonas*(2%) + *Bacillus subtilis*(2%) (2.40) and T₂ - Mancozeb (1%) +
180 *Pseudomonas*(4%) (2.20) followed by T₁ Mancozeb (1%) + *Trichoderma*(4%) (2.0) ,
181 T₆ Mancozeb (1%) + *Bacillus subtilis*(2%) + *Trichoderma*(2%)(1.73), T₃ Mancozeb
182 (1%) + *Bacillus subtilis*(4%) (1.53) as compared to T₇ - Mancozeb (1%) (1.33) and
183 T₀ – untreated control- (1.06). All the treatments were significant over untreated
184 control.

185 **4.2.2 No. of Branches at 60 DAS**

186 The data presented in table 4.2 and depicted in figure 4.2 reveals that
187 maximum plant height (cm) of okra at 60 DAS was recorded in T₄ - Mancozeb (1%)
188 + *Trichoderma*(2%) + *Pseudomonas*(2%) (6.33) followedby T₅ - Mancozeb (1%) +
189 *Pseudomonas*(2%) + *Bacillus subtilis*(2%) (5.73) and T₂ - Mancozeb (1%) +
190 *Pseudomonas*(4%) (5.53) followed by T₁ Mancozeb (1%) + *Trichoderma*(4%) (5.33) ,
191 T₆ Mancozeb (1%) + *Bacillus subtilis*(2%) + *Trichoderma*(2%)(5.13), T₃ Mancozeb
192 (1%) + *Bacillus subtilis*(4%) (4.86) as compared to T₇ - Mancozeb (1%) (4.60) and
193 T₀ – untreated control- (4.33). All the treatments were significant over untreated

194 control , Among the treatments (T₆ and T₃) (T₃ and T₂) (T₂ and T₇) were
195 statistically non significant to each other

196 **4.2.3 No. of Branches at 90 DAS**

197 The data presented in table 4.2 and depicted in figure 4.2 reveals that
198 maximum plant height (cm) of okra at 90 DAS was recorded in T₄ - Mancozeb (1%)
199 + *Trichoderma*(2%) + *Pseudomonas*(2%) (8.63) followedby T₅ - Mancozeb (1%) +
200 *Pseudomonas*(2%) + *Bacillus subtilis*(2%) (8.30) and T₂ - Mancozeb (1%) +
201 *Pseudomonas*(4%) (7.96) followed by T₁ Mancozeb (1%) + *Trichoderma*(4%) (7.63) ,
202 T₆ Mancozeb (1%) + *Bacillus subtilis*(2%) + *Trichoderma*(2%)(7.26), T₃ Mancozeb
203 (1%) + *Bacillus subtilis*(4%) (7.13) as compared to T₇ - Mancozeb (1%) (7.03) and
204 T₀ – untreated control- (6.63). All the treatments were significant over untreated
205 control , Among the treatments (T₇ and T₄) (T₄ and T₈) were statistically non
206 significant to each other

207 **4.2.4 No. of Fruits at 60 DAS**

208 The data presented in table 4.3 and depicted in figure 4.3 reveals that
209 maximum plant height (cm) of okra at 60 DAS was recorded in T₄ - Mancozeb (1%)
210 + *Trichoderma*(2%) + *Pseudomonas*(2%) (3.60) followedby T₅ - Mancozeb (1%) +
211 *Pseudomonas*(2%) + *Bacillus subtilis*(2%) (3.26) and T₂ - Mancozeb (1%) +
212 *Pseudomonas*(4%) (3.00) followed by T₁ Mancozeb (1%) + *Trichoderma*(4%)(2.80) ,
213 T₆ Mancozeb (1%) + *Bacillus subtilis*(2%) + *Trichoderma*(2%)(2.60), T₃ Mancozeb
214 (1%) + *Bacillus subtilis*(4%) (2.26) as compared to T₇ - Mancozeb (1%) (1.86) and
215 T₀ – untreated control- (1.60). All the treatments were significant over untreated
216 control.

217 **4.2.5 No. of Fruits at 75 DAS**

218 The data presented in table 4.3 and depicted in figure 4.3 reveals that
219 maximum plant height (cm) of okra at 75 DAS was recorded in T₄ - Mancozeb (1%)
220 + *Trichoderma*(2%) + *Pseudomonas*(2%) (6.26) followedby T₅ - Mancozeb (1%) +
221 *Pseudomonas*(2%) + *Bacillus subtilis*(2%) (6.00) and T₂ - Mancozeb (1%) +
222 *Pseudomonas*(4%) (5.80) followed by T₁ Mancozeb (1%) + *Trichoderma*(4%) (5.53) ,
223 T₆ Mancozeb (1%) + *Bacillus subtilis*(2%) + *Trichoderma*(2%)(5.26), T₃ Mancozeb
224 (1%) +
225 *Bacillus subtilis*(4%) (5.06) as compared to T₇ - Mancozeb (1%) (4.80) and T₀ –
226 untreated control- (4.26). All the treatments were significant over untreated control.

227 **4.2.6 No. of Fruits at 90 DAS**

228 The data presented in table 4.3 and depicted in figure 4.3 reveals that
229 maximum plant height (cm) of okra at 90 DAS was recorded in T4 - Mancozeb (1%)
230 + *Trichoderma*(2%) + *Pseudomonas*(2%) (9.23) followed by T5 - Mancozeb (1%) +
231 *Pseudomonas*(2%) + *Bacillus subtilis*(2%) (9.00) and T2 - Mancozeb (1%) +
232 *Pseudomonas*(4%) (8.96) followed by T₁ Mancozeb (1%) + *Trichoderma*(4%)(8.63) ,
233 T₆ Mancozeb (1%) + *Bacillus subtilis*(2%) + *Trichoderma*(2%)(8.16), T₃ Mancozeb
234 (1%) + *Bacillus subtilis*(4%) (8.10) as compared to T7 - Mancozeb (1%) (7.90) and
235 T0 – untreated control- (7.00). All the treatments were significant over untreated
236 control. Among the treatments (T₃ and T₆) (T₂ and T₇) were statistically non
237 significant to each other

238

239 DISCUSSION :-

240 In the present study, the **Plant height of okra** at 60,75 and
241 90 DAS was significantly increased by the use of Mancozeb (1%) +
242 *Trichoderma*(4%) + *Pseudomonas*(4%).

243 The No. of **Branches of okra** at 60,75 and 90 DAS was
244 significantly increased by the use of Mancozeb (1%) +
245 *Trichoderma*(4%) + *Pseudomonas*(4%).

246 The **No. of Fruits of okra** at 60,75 and 90 DAS was
247 significantly increased by the use of Mancozeb (1%) +
248 *Trichoderma*(4%) + *Pseudomonas*(4%).

249 **Maximum Plant height , No. of Branches , no. of fruits**
250 was observed in Mancozeb (1%) + *Trichoderma*(4%) +
251 *Pseudomonas*(4%) the probable reason for such finding may be
252 because of the inhibitory effect of bio-agents due to hyper
253 parasitism/mycoparasitism, competition for space and nutritional
254 source and antagonistic chemical produced by them . *Trichoderma*
255 *sp.* , *Pseudomonas* has been reported to produce antibiotic
256 compounds (Trichodermin), extracellular enzymes (chitinase,
257 cellulose) unsaturated monobasic acids (Dermadine) and peptides

258

259 From this present study entitled “**Efficacy of bio control agents**
260 **with chemical fungicides against *Cercospora* leaf spot of Okra**
261 **(*Abelmoschus esculentus* L.) Moench**” based on the observations
262 it can be concluded that the efficacy of combining readily available and
263 ecologically safe bioagents with synthetic safe mancozeb fungicide for the
264 management of *Cercospora* leaf spot of okra .

265 From the critical analysis of the present findings, it can be
266 concluded that after the application of all the treatments with three
267 replications, T4 - Mancozeb (1%) + *Trichoderma*(2%) +
268 *Pseudomonas*(2%) is the best treatment as it showed The **GROWTH**
269 **PARAMETERS** at 60,75 and 90 DAS which was significantly
270 increased by the use of Mancozeb (1%) + *Trichoderma*(4%) +
271 *Pseudomonas*(4%) under Prayagraj Agro climatic conditions . Based
272 on analysis T4 - Mancozeb (1%) + *Trichoderma*(2%) +
273 *Pseudomonas*(2%) is recommended to control the *cercospora* leaf
274 spot disease in Okra. The present findings were limited to one crop
275 season *kharif* under the climatic conditions of Prayagraj , U.P. ,
276 therefore substantiate the present result more trails are required for
277 further recommendations .

278

279 Acknowledgement :-

280 I would like to thank Dr.(Mrs.) Shashi Tiwari for her motivation and
281 guidance.

282 Reference

283

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285 seeds and skims. *Food Chemistry*, **110**: 1041-1045.

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DEFINITIONS, ACRONYMS, ABBREVIATIONS

309 Here is the Definitions section. This is an optional section.

310 **Term:** Definition for the term

311

312 **APPENDIX**

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UNDERPEERREVIEW