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## ORGANIC MANAGEMENT OF PURPLE LEAF BLOTCH OF ONION (*ALTERNARIA PORRI*)

Sairam K.<sup>1</sup>, Gopal K.<sup>2</sup>, Arunodhayam K.<sup>3</sup> and Ruth Ch.<sup>3</sup>,

<sup>1</sup>Department of Plant Pathology, J.C.D.R. Horticultural College, Tadipatri, Andhra Pradesh, India.

<sup>2</sup>Dr. Y.S.R. Horticultural University, Venkataramannagudem, A.P., India.

<sup>3</sup>Department of Plant Pathology, College of Horticulture, Anantharajupeta, Andhra Pradesh, India.

\*Corresponding author E-Mail: [sairam.kudupudi58@gmail.com](mailto:sairam.kudupudi58@gmail.com)

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### ABSTRACT

Purple leaf blotch of onion (*Alternaria porri*) is most devastating disease of onion in India and a challenge for producer is to find the effective means of control for this disease. *in vivo* studies on organic management of purple leaf blotch of onion experiment were carried out in the Department of Plant Pathology farm, College of Horticulture, Anantharajupeta. Studies were conducted to know the efficacy of organic amendment and plant extracts and tested them in *in vitro* and the effective organic amendment and plant extract was applied *in vivo*. Results revealed that lowest per cent disease index (19.54%), Lowest AUDPC (1243.28), lowest r-value (0.01) and Highest bulb yield (6,680 kg ha<sup>-1</sup>) was recorded in T1 (seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + spray of Panchagavya 10%) found most effective and followed by T2 (S.T. with *T. harzianum* @ 8g kg<sup>-1</sup> + Neem leaf extract 10% - spray) with 20.67 per cent disease index, AUDPC (1264.61), and bulb yield (5,580 kg ha<sup>-1</sup>).

**Key words:** Onion, Panchagavya, *Alternaria porri*, *Trichoderma harzianum*, Neem leaf extract

### Introduction

Onion (*Allium cepa* L) is extremely important vegetable crop not only for internal consumption but also as highest foreign exchange earner among the fruits and vegetables. Onion belongs to the family Alliaceae. According to Vavilov (1951) the primary center of origin is Central Asia and the near East and Mediterranean are the secondary centers of origin. Onion has manifold uses as spice, vegetable, salad dressing *etc*, hence it is known as “queen of kitchen”. Onion is rich in sulphur containing compounds that are responsible for their pungent odours and for many of their health promoting effects. Onion bulb is a rich source of minerals like calcium and phosphorus. It also contains proteins and vitamin C. The main component which is responsible for the pungency in onion is an alkaloid “Allylpropyl disulphide”. Onions are now days used in several ways as in fresh, frozen, canned, caramelized, pickled, powdered, chopped and dehydrated forms.

The reason for very low productivity may be attributed

to occurrence of diseases *viz.*, purple blotch, *stemphylium* blight, downy mildew, basal rot and storage rots *etc*. (Priya *et al.*, 2016) and non-availability of varieties resistant to biotic and abiotic stresses. Among the foliar diseases, purple blotch is one of the most destructive diseases, commonly prevailing in almost all onion growing pockets of the world, which causes heavy loss in onions under field conditions, ranging from 30 to 100%.

### Materials and Methods

#### Field experiment

A trail was conducted during *kharif*, under field conditions at College of Horticulture, Anantharajupeta determined the effective plant extracts, organic amendments and biological agents against *A. porri*.

#### Geographical location of experimental site

The experimental site was located at College of Horticulture, Anantharajupeta that falls under tropical zone of Rayalaseema region of Andhra Pradesh with an average rainfall of 700 mm and is situated at an altitude of 162

**Table 1:** Symptoms of expression and date of initiation of disease.

S. no	Treatments	Symptoms of expression (0-5 Scale)	Date of initiation of disease
T1	Seed treatment with <i>T.harzianum</i> @ 8g kg <sup>-1</sup> +Panchagavya @ 10 %	1	69 DAP
		2	75 DAP
		3	90 DAP
		4	-
		5	-
T2	Seed treatment with <i>T. harzianum</i> @ 8g kg <sup>-1</sup> + Neem leaf extract @ 10 %	1	69 DAP
		2	75 DAP
		3	90 DAP
		4	-
		5	-
T3	Seed treatment with <i>T. harzianum</i> @ 8g kg <sup>-1</sup> Panchagavya followed by neem leaf extract@ 10 %	1	69 DAP
		2	75 DAP
		3	90 DAP
		4	-
		5	-
T4	Seed treatment with <i>T. harzianum</i> @ 8g kg <sup>-1</sup> Mancozeb 75% WP 2.5g L <sup>-1</sup>	1	69 DAP
		2	72 DAP
		3	85 DAP
		4	89 DAP
		5	-
T5	Seed treatment with <i>T. harzianum</i> @ 8g kg <sup>-1</sup> (Control)	1	69 DAP
		2	72 DAP
		3	80 DAP
		4	84 DAP
		5	89 DAP

**0-5 scale**  
0 - No disease symptoms  
1 - A few spots towards tip covering 10 per cent leaf area  
2 - Several dark purplish brown patch covering up to 20 per cent leaf area.  
3 - Several patches with pale outer zone covering up to 20 per cent leaf area  
4 -Leaf streaks covering up to 75 per cent leaf area or breaking of the leaves from center  
5 -Complete drying of the leaves or breaking of the leaves from center.

meters (531 feet) above mean sea level. The geographical situation is 13.980 N latitude & 79.400 E longitudes.

### Characteristics of soil

The soil of the experimental area was red sandy. The pH of the soil was 7.5. The characteristics of the soil under the experimental plot was analyzed in the soil testing Laboratory, COH, Anantharajupeta.

### Planting materials

In this research work, the seeds of onion were used as planting materials. The seeds of the onion were collected from a farmer in kurnool.

A field experiment was conducted during *kharif* at the College of Horticulture, Anantharajupeta, to study the efficacy of organic amendment and plant extracts,

we tested them in laboratory conditions and used the efficient organic amendment and plant extract *in vivo*. Where in first spray was imposed immediately after the appearance of disease symptoms followed by four sprays at an interval of 15 days. The severity of the purple leaf blotch disease was recorded on 10 randomly selected plants in from each treatment.

### Experimental details

Crop	Onion ( <i>Alium cepa</i> ) var. Bellari Red
Location	College of Horticulture, Anantharajupeta.
Statistical design	RBD
Treatments	5
Replication	4
Spacing	30 × 20 cm

**Treatment details:** In all treatments seed treatment with potential antagonist formulation @ 8g kg<sup>-1</sup> seed and soil application with enriched potential antagonist @ 100 kg ha<sup>-1</sup> was done.

Treatment	Description
T1	The effective organic amendment was sprayed immediately after first appearance of the symptoms and remaining 3 sprays were sprayed at 15 days interval.
T2	The effective plant extract was sprayed immediately after first appearance of the symptoms and remaining 3 sprays were sprayed at 15 days interval.
T3	Two sprays of effective organic amendment immediately after first appearance of the symptoms alternated by effective plant extract at 15 days interval.
T4	Mancozeb 2.5 g lit <sup>-1</sup> . (4 sprays at 15 days interval recommended practice)
T5	Control.



**Plate 1:** Symptoms development of purple leaf blotch of onion.

## Observations recorded

Observations on disease index severity recorded with the appearance of the disease and then at 7 days interval. For recording intensity of the disease ten plants were selected randomly in each treatment in all replications. All the leaves of selected plants were scored individually by following 0-5 scale (Sharma, 1986) and per cent disease index was calculated by using the formula given by Wheeler (1969).

$$\text{PDI} = \frac{\text{Total sum of numerical ratings}}{\text{Number of observations} \times \text{Maximum disease rating}} \times 100$$

### 0-5 scale

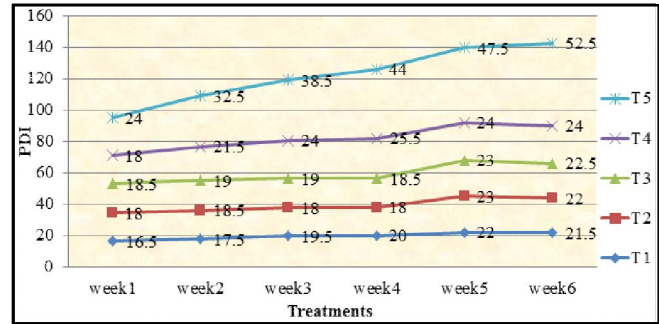
- 0 - No disease symptoms
- 1 - A few spots towards tip covering 10 per cent leaf area
- 2 - Several dark purplish brown patch covering up to 20 per cent leaf area.
- 3 - Several patches with pale outer zone covering up to 20 per cent leaf area
- 4 - Leaf streaks covering up to 75 per cent leaf area or breaking of the leaves from center
- 5 - Complete drying of the leaves or breaking of the leaves from centre.

## Result and Discussion

The results indicated that there was difference among the different treatments with respect to disease and yield. The per cent disease index recorded varied from 19.54



**Plate 2:** Photograph showing conidia of *A. porri* observed under compound microscope (10X).



**Fig. 1:** Influence of treatments on purple leaf blotch disease progress in onion. [T1: Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + Panchagavya @ 10 per cent; T2: Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + Neem leaf extract @ 10 percent; T3: Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> Panchagavya followed by neem leaf extract @ 10 per cent; T4: Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> Mancozeb 75% WP 2.5g L<sup>-1</sup>; T5: Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> (Control).]

to 40.25. Lowest per cent disease index 19.54 per cent was recorded in T1 (Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + spray of Panchagavya 10%) which was found most effective and significantly superior over other treatments, which was on par with T2 (Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + Neem leaf extract 10%-spray) with 20.67 per cent disease index, T3 (Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + spray of panchagavya 10% followed by neem leaf extract 10%



**Plate 3:** Photograph showing conidia of *A. porri* with transverse and longitudinal septa in microscope (40X).



**Plate 4:** Field view of disease management experiment.

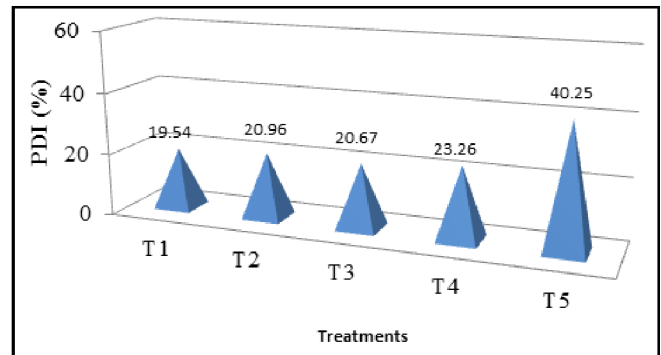
**Table 2:** Influence of treatments on purple leaf blotch disease progress in onion.

Treat-ments	69 DAP	76 DAP	83 DAP	90 DAP	97 DAP	103 DAP
T1R1	18.00	18.00	22.00	20.00	24.00	22.00
T1R2	16.00	18.00	18.00	16.00	22.00	20.00
T1R3	20.00	16.00	20.00	20.00	20.00	22.00
T1R4	12.00	18.00	18.00	24.00	22.00	22.00
<b>Mean</b>	<b>16.50</b>	<b>17.50</b>	<b>19.50</b>	<b>20.00</b>	<b>22.00</b>	<b>21.50</b>
T2R1	16.00	18.00	16.00	16.00	26.00	22.00
T2R2	16.00	16.00	16.00	16.00	22.00	20.00
T2R3	20.00	22.00	24.00	24.00	20.00	20.00
T2R4	20.00	18.00	16.00	16.00	24.00	26.00
<b>Mean</b>	<b>18.00</b>	<b>18.50</b>	<b>18.00</b>	<b>18.00</b>	<b>23.00</b>	<b>22.00</b>
T3R1	16.00	18.00	24.00	20.00	24.00	22.00
T3R2	22.00	16.00	18.00	24.00	22.00	20.00
T3R3	22.00	20.00	22.00	18.00	20.00	24.00
T3R4	14.00	22.00	22.00	22.00	26.00	24.00
<b>Mean</b>	<b>18.50</b>	<b>19.00</b>	<b>19.00</b>	<b>18.50</b>	<b>23.00</b>	<b>22.50</b>
T4R1	16.00	22.00	22.00	24.00	24.00	24.00
T4R2	20.00	18.00	24.00	28.00	28.00	22.00
T4R3	18.00	24.00	24.00	22.00	26.00	24.00
T4R4	18.00	22.00	26.00	28.00	30.00	24.00
<b>Mean</b>	<b>18.00</b>	<b>21.50</b>	<b>24.00</b>	<b>25.50</b>	<b>24.00</b>	<b>24.00</b>
T5R1	22.00	30.00	38.00	46.00	50.00	54.00
T5R2	28.00	32.00	36.00	40.00	42.00	54.00
T5R3	22.00	36.00	38.00	42.00	46.00	48.00
T5R4	24.00	32.00	42.00	48.00	52.00	54.00
<b>Mean</b>	<b>24.00</b>	<b>32.50</b>	<b>38.50</b>	<b>44.00</b>	<b>47.50</b>	<b>52.50</b>

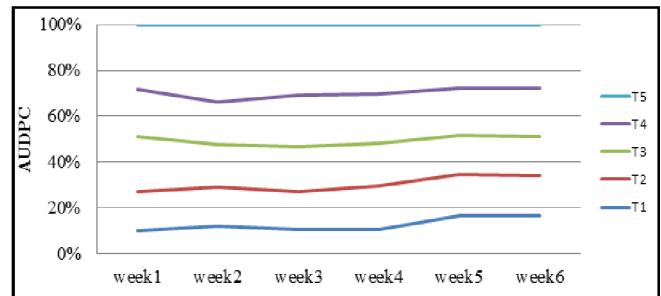
**T1** : Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + Panchagavya @ 10 per cent.  
**T2** : Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + Neem leaf extract @ 10 percent  
**T3** : Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> Panchagavya followed by neem leaf extract @ 10 per cent.  
**T4** : Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> Mancozeb 75% WP 2.5g L<sup>-1</sup>.  
**T5** : Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> (Control).

at 15 days interval) with 20.96 per cent disease index. The next best treatment was T4 (Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + Spray of mancozeb 75% WP 2.5g L<sup>-1</sup>) with 23.26 per cent PDI. Among these treatments highest PDI recorded in T5 (Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup>) with per cent disease index of 40.25. (Table 2 and Plate 5)

The results indicated that there was difference among the different treatments with respect to AUDPC. AUDPC recorded varied from 1243.28 to 2100.15. Lowest AUDPC in T1 (Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + spray of Panchagavya 10%) 1243.28 followed by T2 (Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + Neem leaf extract 10%- spray) with 1264.61, T3 (Seed treatment with *T. harzianum* @



**Fig. 2:** Influence of effective organic amendment and plant extract on purple leaf blotch disease severity in onion.



**Fig. 3:** Influence of effective organic amendment and plant extract on purple leaf blotch disease progress in onion.

8g kg<sup>-1</sup> + spray of panchagavya 10% followed by neem leaf extract 10% at 15 days interval) with 5,180, T4 (Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + Spray of mancozeb 75% WP 2.5g L<sup>-1</sup>) with 1607.34, T5 (Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup>) with 2100.15. Among these treatments highest AUDPC recorded in T5 (Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup>) with 2100.1 (Table 2 and Plate 1).

The results showed that there was slight difference among the different treatments with respect to r- rate of infection. Lowest r- value recorded in T1 (Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + spray of Panchagavya 10%) 0.01. Among these treatments highest r- value recorded in recorded in T5 (Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup>) with 0.03 (Table 2 and Fig. 3).



**Plate 5 :** Treatment proved best with T1: Seed treatment with *T. harzianum*@ 8g kg<sup>-1</sup> +Panchagavya @ 10% concentration

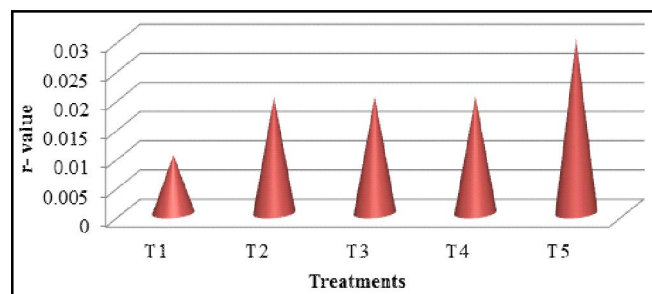
**Table 3:** Influence of effective organic amendment and plant extract on purple leaf blotch disease severity and disease progress in onion.

Treatments	Per cent Disease Index (PDI)	AUDPC	Rate of infection (r- value)
T1	19.54 (23.48)*	1243.28	0.01
T2	20.67 (27.03)	1264.61	0.02
T3	20.96 (27.25)	1350.30	0.02
T4	23.26 (28.83)	1607.34	0.02
T5	40.25 (39.38)	2100.15	0.03
SEm±	0.840		
C.D (P0.05)	2.168		

\*Figures in the parenthesis are angular transformed values

**T1** : Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + Panchagavya @ 10 per cent.  
**T2** : Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + Neem leaf extract @ 10 percent  
**T3** : Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> Panchagavya followed by neem leaf extract @ 10 per cent.  
**T4** : Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> Mancozeb 75% WP 2.5g L<sup>-1</sup>.  
**T5** : Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> (Control).

Effect of treatment on the bulb yield was found significant and varied from 6,680 to 2,740 kg ha<sup>-1</sup>. Highest bulb yield of 6,680 kg ha<sup>-1</sup> was recorded in T1 (Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + spray of Panchagavya 10%) which was significantly superior over all other treatments followed by T2 (Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + spray of Neem leaf extract 10%) 5,580 kg ha<sup>-1</sup>. Moderate bulb yield was recorded in T3 (Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + spray of panchagavya 10% followed by neem leaf extract 10% at 15 days interval) 5,180 kg ha<sup>-1</sup>, which was followed by T4 (Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + spray of mancozeb 75% WP 2.5g L<sup>-1</sup>) 3,740 kg ha<sup>-1</sup>. Among all these treatments lowest bulb yield was recorded in T5 (Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup>) 2,040 kg ha<sup>-1</sup> g ha<sup>-1</sup>. (Table 3 and Fig. 4)

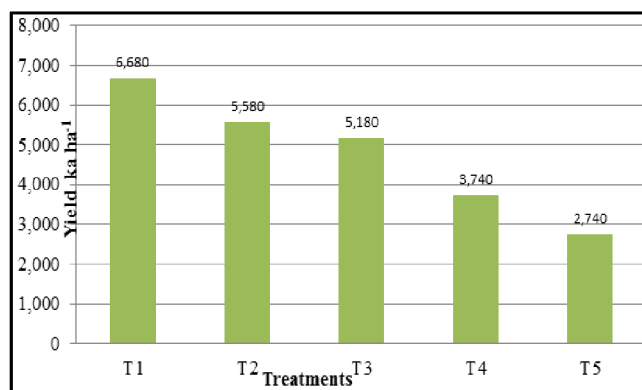
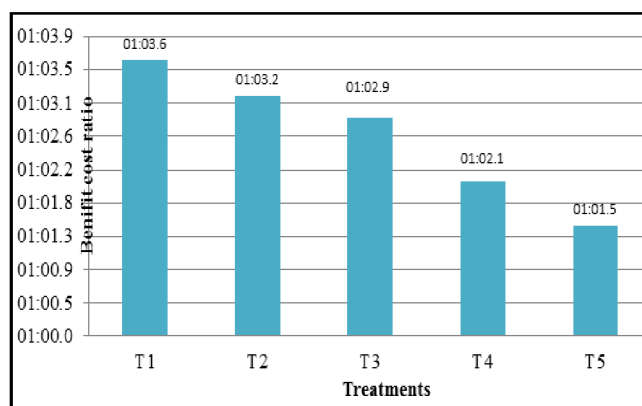
**Fig. 4:** Rate of infection (r- value) of *Alternaria porri*.

[**T1**: Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + Panchagavya @ 10 per cent; **T2**: Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + Neem leaf extract @10 percent; **T3**: Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> Panchagavya followed by neem leaf extract @ 10 per cent; **T4**: Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> Mancozeb 75% WP 2.5g L<sup>-1</sup>; **T5**:Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> (Control).]

**Table 4:** Efficacy of effective plant extract and organic amendment on yield and benefit cost ratio in management of purple leaf blotch disease in onion.

Treatments	Yield (kg ha <sup>-1</sup> )	BCR
T1	6,680	1:3.62
T2	5,580	1:3.16
T3	5,180	1:2.88
T4	3,740	1:2.06
T5	2,040	1:1.48
SEm±	0.213	
C.D (P0.05)	0.663	

**T1** : Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + Panchagavya @ 10 per cent.  
**T2** : Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + Neem leaf extract @ 10 percent  
**T3** : Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> Panchagavya followed by neem leaf extract @ 10 per cent.  
**T4** : Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> Mancozeb 75% WP 2.5g L<sup>-1</sup>.  
**T5** : Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> (Control).

**Fig. 5:** Efficacy of effective plant extract and organic amendment on onion bulb yield.**Fig. 6:** Efficacy of effective plant extract and organic amendment on benefit cost ratio in management of purple leaf blotch disease in onion. [**T1**: Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + Panchagavya @ 10 per cent; **T2**: Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + Neem leaf extract @10 percent; **T3**: Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> Panchagavya followed by neem leaf extract @ 10 per cent; **T4**: Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> Mancozeb 75% WP 2.5g L<sup>-1</sup>; **T5**:Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> (Control).]

In the light of present day constraints in plant disease management practices especially those on the use of potentially hazardous pesticides, organic management is increasingly occupying the minds of scientists and farmers all over the world. Organics provides economical and relatively non polluting delivery systems for protective materials compared to other field application systems. Several workers have reported organic management and effective antagonistic potential of both fungal and bacterial antagonistic microorganisms. In recent years, the use of antagonists has gained more importance. These antagonistic organisms act on the pathogen by different mechanisms *viz.*, competition lysis, antibiosis, siderophore production and hyperparasitism thereby reducing the inoculum (Vidyasekaran, 1999). Formulations of organics are available at cheaper rate and these products when once introduced it survives for a longer period with minimum interference of biological equilibrium (Papavizas, 1973).

The Plant extracts and bio agents which were found effective in the laboratory conditions were tested in the field panchagavya 10 per cent concentration and neem leaf extract 10 per cent concentration, *Trichoderma harzianum* @ 8 g kg<sup>-1</sup> were evaluated under field conditions. Four sprays were given at 15 days interval starting from disease development.

Experimental results revealed that panchagavya was effective in minimizing the per cent disease index and getting higher yields, In the present studies, T1 followed by T2 recorded the less per cent disease index of 19.54 and 20.96 respectively. This resulted in getting high yield of 6,680 kg ha<sup>-1</sup>. The next best treatment was T2 with a PDI of 20.96 and a bulb yield of 5,580 kg ha<sup>-1</sup>, followed by T4 with a PDI of 23.26 and a bulb yield of 5,180 kg ha<sup>-1</sup> and T3 with per cent disease index of 20.67 and yield of 3,740 kg ha<sup>-1</sup> respectively. T5, with 40.25 per cent disease index proved least effective to control purple blotch.

Several workers have reported the effectiveness of Pachagavya and Neem leaf extract in control of diseases caused by several pathogens (Sireesha, 2013) The efficiency of bio-control agent may be determined by various factors *viz.*, the soil temperature and soil reaction (Harman *et al.*, 1981), the kind of soil and its microbiota (Hadar *et al.*, 1984), the inoculants density on the seed (Papavizas *et al.*, 1982), the inoculums potential of the pathogen in soil, the rate of application of the antagonist to soil (Elad *et al.*, 1980).

Several workers have reported the effectiveness of *T. harzianum* in control of diseases caused by *Alternaria* (Abo-Elyousr *et al.*, 2014; Takur and Harsh, 2014; Mohan

*et al.*, 2001; Amaresh *et al.*, 2004; Meena *et al.*, 2004; Patni *et al.*, 2005; Sanjeet *et al.*, 2005; Shahnaz *et al.*, 2013; Arunakumara *et al.*, 2016).

Considering benefit cost ratio, among different treatments the most economical treatment which recorded highest BCR in T1 (Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + spray of Panchagavya 10%) with (1:3.62), which was followed by T2 (Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + Neem leaf extract 10%- spray) with (1:3.16), T3 (Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + spray of panchagavya 10% followed by neem leaf extract 10% at 15 days interval) with (1:2.88), T4 (Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + Spray of mancozeb 75% WP 2.5g L<sup>-1</sup>) with (1:2.06). Among all the treatments T5 (Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup>) with (1:1.48) recorded lowest BCR. (Table 4 and Fig. 5)

Regarding to benefit cost ratio, among different treatments the most economical treatment which recorded highest BCR was T1 (Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + spray of Panchagavya 10%) with (1:3.62), and followed by T2 (Seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + Neem leaf extract 10%- spray) with (1:3.16), were found effective with better BCR.

## Conclusion

Results revealed that among five treatments, lowest per cent disease index, Lowest AUDPC, lowest r-value and Highest bulb yield was recorded in T1 (seed treatment with *T. harzianum* @ 8g kg<sup>-1</sup> + spray of Panchagavya 10%) found most effective in controlling purple blotch of onion.

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