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Field Evaluation of Fungicides for the Management of Purple blotch in Onion

ARJUNSINH RATHAVA, RANGANATHSWAMY MATH AND MANISH R DABHI
College of Agriculture. Anand Agricultural University, Jabugam, Ta- Bodeli, Dist- ChhotaUdepur-391 155, Gujarat

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The aim of this study was to investigate the effects of different fungicides on the management of Purple blotch in onion. The investigation was carried out for two years(Year 2021-22 and 2022-23) at experimental field of College of Agriculture, A.A.U., Jabugam, Gujarat. The experiment was laid out in randomized block design with three replications and nine treatments. Fungicides were applied two times at 10 days interval after initiation of disease and results showed that among the tested treatments including control, Kresoxim-methyl 15% + Chlorothalonil 56% WG, 0.177 % recorded lowest disease intensity (19.51%) with highest bulb yield (472 q/ha) and it was significantly superior over control. From the above result it was concluded that among different treatments evaluated, foliar spray with Kresoxim-methyl 15% + Chlorothalonil 56% WG @ 0.177 was found more effective for the management of purple blotch in onion

Keywords : *Alternaria porri,* fungicides, onion, Purple blotch, management

INTRODUCTION

Onion (*Allium cepa*) a bulbous, biennial herb, is one of the most important vegetable crops grown thought world. Among vegetables, onion often called as "queen of kitchen" is one of the oldest known and an important crop grown in India. Onion is supposed to have its origin in the Middle East Asian Countries and introduced in India from Palestine. It belongs to family *Alliaceae,* and genus Allium with about 300 species.

It is valued for its distinct pungent flavour and is an essential ingredient in the cuisine of many regions (Seth *et al.* 2018). Onion is used either in raw form or dehydrated form to add flavour and taste to Indian cuisines.Onion has medicinal value it is used in some pharmaceutical preparation. The pungency in onion is due to a volatile oil known as allyl-propyl disulphide. It rejuvenates the body, removes toxins, revitalises the bloodstream and stimulates blood circulation in the body (Tripathi and Lawande, 2006).

The composition of onion varies according to variety, agronomic and environmental conditions of growth. It is a rich source of amino acids, anthocyanin's, flavones and phenolics (Pérez-Gregorio *et al.* 2014**).** The onion bulb is rich in minerals like phosphorous, calcium and carbohydrate (Bhattacharjee*et al.* 2013). Common onion ranks medium in the supply of proteins, caloric value and vitamin B and C. Also,onions are a common source of folic acid. However small onions were more nutritive than big onions.

India is a traditional producer and holds second global position in onion production. It is cultivated in the area 1.91 million hectares with the production of 31.27 Milliontonnes(Anonymous, 2022a). The major Onion producing states are Maharashtra, Madhya Pradesh, Karnataka, Gujarat,Rajasthan, Bihar,West Bengal,Andhra Pradesh, Haryana and Uttar Pradesh in the country. These states account for almost 90% of the total onion production of the country. In Gujarat, the total area under cultivation is 82197 hectares with a production of 2.109milliontonnes overall. **(**Anonymous, 2022 b**).**Bhavnagar, Amreli, Rajkot,

*Correspondence : rathvaarjun27@gmail.com

Junagadh, Jamnagar,Kutch, Porbandar, Gir somnath, Dahod and Surendranagar are the principal onion growing regions of Gujarat.

It is cultivated round the year throughout the country. Onion is highly susceptible to many foliar, bulb and root pathogens, which reduce its yield and quality (Cramer, 2000). 36 diseases have been reported to be prevailing in Indiaincluding 29 fungal, 3 viral and 4 bacterial diseases. The purple blotch (*Alternaria porri*) is one of the major constraints in onion cultivation.Purple blotch is more common in kharif season and caused by *Alternaria porri*. The pathogen is polyphagous infecting crop like onion, garlic, shallot and other Allium crops. The fungus attacks both leaves and flower stalk, reducing foliar production by 62-92%. Hot and humid climate with temperature ranging from 21 to 30°C and relative humidity (80 to 90%) favours the development (sporulation) of the disease. Initially, small white sunken spots develop on the leaves and enlarge, become eye shaped under moist conditions, turn to purple colour and are surrounded by a broad chlorotic margin. Lesions may girdle leaves and stalks causing them to drop after 2-3 weeks.The yield loss of onion in India due to this disease under favourable conditions varies from 5.0 to 96.5 per cent.Yadav *et al.*(2013)reported that around 80% yield loss of onionin India is caused by purple blotch disease.

Several workers showed effectiveness of fungicides against this disease like mancozeb (Wanggikar*et al.* 2014), Zineb and captafol; hexaconazole (Wanggikar *et al.* 2014), Difenconazole (Jhala and Mali, 2017); tebuconazole and propiconazole (Yadav *et al.* 2017, Bachkar *et al.* 2018). The present study was carried out to evaluate the bio-efficacyof ready mix fungicides against *Alternaria porri* (Ellis) Cif. causing purple blotch of onion for effective management

MATERIALS AND METHODS

A field experiment was conducted to evaluate the efficacy of different fungicide against purple blotch in onionunder field condition for twoyears - 2021-22 & 2022-23 at experimental field of Agriculture Research Station, Jabugam during *rabi* season. Onion variety Gujarat Anand White Onion 2 (GAWO-2) was sown and trial was laid out in a Randomized block design with 9 treatments and 3 replications (Table 1, Fig. 1 A & B).The concentration and formulation of the fungicides were determined using the standard dose, as well as doses that were 25 percent higher and 25 percent lower for each fungicide. Metiram 55% + Pyraclostrobin 5% WG was used as Check.Recommended agronomic practices were followed for raising the crop. The first spray of fungicides was given at the initiation of the disease and subsequently second spray was applied after 10 days of first spray. Disease intensity for purple blotch was recorded at 10 days interval after first and second spray from 10 selected plants from each treatment. Disease was recorded on five leaves as per scale given by (Sharma (1986)(Table 2). Symptoms of disease have been depicted in Fig. 2.

RESULTS AND DISCUSSION

All the tested fungicides were effective in controlling purple blotch in onion in the field during two consecutive years of study. The tested fungicides showed variation withrespect to disease intensity (%) and yield (kg/plot)during two years.

In the first year (2021-22), Initial observation on purple blotch intensity before spray was found non-significant among the treatments. Observation on disease intensity pooled over sprays revealed that treatment number - 3 *i.e.* Kresoxim-methyl 15% + Chlorothalonil 56% WG @ 0.177 recorded significantly lower disease intensity (19.29%) compared to other treatments (Table 3).Observations on bulb yield revealed that treatment number - 3 *i.e.* Kresoxim-methyl 15% + Chlorothalonil 56% WG @ 0.177 recorded significantly highest bulb yield (668 q/ha) compared to other treatments. The lowest bulb yield was recorded in control treatment (499 q/ ha). (Table 4).

In the second year (2022-23) Initial observation on purple blotch intensity before spray was found non-significant among the treatments. Observation on disease intensity pooled over sprays revealed that treatment number - 3 *i.e.*

Table 1: Different fungicides and their concentrations

Tr. No.	Treatments	Conc. (%)	Quantity required (g or ml / 10 litre of water)	g.a.i./ha
T_1	Kresoxim-methyl 15% + Chlorothalonil 56% WG	0.106	15.0	532.50
T_2	Kresoxim-methyl 15% + Chlorothalonil 56% WG	0.142	20.0	710.00
T_3	Kresoxim-methyl 15% + Chlorothalonil 56% WG	0.177	25.0	887.50
T_4	Tebuconazole 50% + Trifloxystrobin 25% WG	0.0281	3.75	140.62
T_5	Tebuconazole 50% + Trifloxystrobin 25% WG	0.0375	5.0	187.50
T_6	Tebuconazole 50% + Trifloxystrobin 25% WG	0.046	6.25	234.37
T_7	Metiram 55% + Pyraclostrobin 5% WG (Check)	0.036	6.0	180.00
T_8	Control (water spray)	-	-	-
T_9	Control	-	-	-

Table 2: Disease rating scale for purple blotch in oniongiven by Sharma (1986).

Score/Grade	Description (per cent area infection)
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 paler outer zone covering up to 40 per cent leaf area
4	Leaf streaks covering up to 75 per cent leaf area or breaking of the leaves from centre
5	Complete drying of the leaves or breaking of the leaves from centre

- Per cent disease intensity (PDI) was calculated by following formula:

$$\text{PDI} = \frac{\text{Sum of all numerical ratings}}{\text{No. of leaves observed} \times \text{Maximum rating scale}} \times 100$$

Kresoxim-methyl 15% + Chlorothalonil 56% WG @ 0.177 recorded significantly lower disease intensity (19.72%) compared to other treatments. The control recorded highest disease intensity of purple blotch disease (32.96%) (Table3). Observations on bulb yield revealed that treatment number - 3 *i.e.* Kresoxim-methyl 15% + Chlorothalonil 56% WG @ 0.177 recorded significantly highest bulb yield (464 q/ha) which was statistically at par with treatment number - 6 *i.e*Tebuconazole 50% + Trifloxystrobin 25% WG@ 0.046 (422 q/ha) (Table 4).

The pooled data of three years (Year 2021-22 and 2022-23) revealed that data on per cent disease intensity pooled over years revealed that all treatments showed lower disease as compared to control (30.74%). Among all the treatments, treatment number - 3 *i.e.* Kresoxim-methyl 15% + Chlorothalonil 56% WG @ 0.177 recorded lower disease intensity (19.51%) and found significantly superior over all other treatments. (Table 3). The data on yield pooled over the years indicated that highest bulb yield was recorded in treatment number - 3 *i.e.* Kresoxim-methyl 15% + Chlorothalonil 56% WG @ 0.177 (472 q/ha). The lowest bulb yield was recorded in the control treatment (347 q/ha) (Table 4).

As per foregoing findings, the fungicides that were determined to be effective belong to a distinct family and have a different mode of action. Kresoxim-methyl considered a strobilurin fungicide targets the mitochondrial electron

Table 3: Efficacy of fungicides against purple blotch of onion (Pooled 2021-22 & 2022-23)

Tr. No	Treatment	Per cent disease intensity (PDI) 2021-22 Before spray	2021-22 1st spray	2021-22 2nd spray	2021-22 Pooled over sprays	2022-23 Before spray	2022-23 1st spray	2022-23 2nd spray	2022-23 Pooled over sprays	Pooled
T_1	Kresoxim-methyl 15% + Chlorothalonil 56% WG	17.19* (8.78)	20.40^{cd} (12.22)	25.34^{b} (18.38)	22.87^{b} (15.30)	17.70* (9.27)	23.15^{b} (15.50)	29.32^{b} (24.00)	26.24^{b} (19.75)	24.56^{b} (17.52)
T_2	Kresoxim-methyl 15% + Chlorothalonil 56% WG	16.43 (8.08)	21.44^{c} (13.39)	24.85^{b} (17.82)	23.14^{b} (15.60)	18.17 (9.75)	22.16^{bc} (14.25)	26.68^{bc} (20.25)	24.42^{cd} (17.25)	23.78^{b} (16.42)
T_3	Kresoxim-methyl 15% + Chlorothalonil 56% WG	15.89 (7.51)	18.51^{d} (10.10)	20.08^{c} (11.93)	19.29^{c} (11.01)	16.30 (7.88)	17.94^{d} (9.50)	21.51^{d} (13.50)	19.72^{f} (11.50)	19.51^{c} (11.25)
T_4	Tebuconazole 50% + Trifloxystrobin 25% WG	15.88 (7.67)	20.25^{cd} (12.07)	25.20^{b} (18.15)	22.72^{b} (15.11)	16.82 (8.38)	22.55^{bc} (14.75)	27.93^{bc} (22.00)	25.24^{bc} (18.37)	23.98^{b} (16.74)
T_5	Tebuconazole 50% + Trifloxystrobin 25% WG	16.43 (8.07)	21.45^{c} (13.39)	25.67^{b} (18.79)	23.56^{b} (16.09)	16.75 (8.33)	21.96^{bc} (14.00)	26.37^{c} (19.75)	24.16^{cd} (16.87)	23.86^{b} (16.48)
T_6	Tebuconazole 50% + Trifloxystrobin 25% WG	15.93 (7.59)	21.93^{bc} (14.00)	24.43^{b} (17.12)	23.18^{b} (15.56)	16.24 (7.83)	20.25^{cd} (12.00)	23.75^{d} (16.25)	21.99^{e} (14.12)	22.59^{b} (14.84)
T_7	Metiram 55% + Pyraclostrobin 5% WG (Check)	16.92 (8.59)	20.69^{cd} (12.51)	23.47^{b} (15.89)	22.08^{b} (14.20)	17.16 (8.73)	19.33^{d} (11.00)	27.40^{bc} (21.25)	23.37d^{e} (16.12)	22.73^{b} (15.16)
T_8	Control (water spray)	16.09 (7.71)	24.57^{ab} (17.33)	30.12^{a} (25.22)	27.35^{a} (21.27)	17.67 (9.25)	25.99^{a} (19.25)	37.44^{a} (37.00)	31.72^{a} (28.12)	29.53^{a} (24.70)
T_9	Control	18.19 (9.79)	25.70^{a} (18.85)	31.32^{a} (27.06)	28.51^{a} (22.95)	18.66 (10.25)	27.43^{a} (21.25)	38.48^{a} (38.75)	32.96^{a} (30.00)	30.74^{a} (26.47)
	S.Em.± Treatment **(**T)	1.03	0.85	1.05	0.65	0.52	0.74	0.81	0.54	0.95
	Spray (S)	-	-	-	0.31	-	-	-	0.25	0.88
	Year (Y)	-	-	-	-	-	-	-	-	0.20
	T X Y	-	-	-	-	-	-	-	-	0.60
	S X Y	-	-	-	-	-	-	-	-	0.28
	T X S	-	-	-	0.93	-	-	-	0.77	0.60
	T XS X Y	-	-	-	-	-	-	-	-	0.60
	CD at 5% T	NS	Sig.	Sig.	Sig.	NS	Sig.	Sig.	Sig.	Sig.
	C.V. (%)	10.78	6.81	7.13	6.83	5.24	5.72	4.88	5.22	6.02

Note:
1. *Figures in parentheses are original values and those outside are arc sine transformed values.
2. Treatment means with the letter(s) in common are not significant by DNMRT at 5% level of significance
3. S: Significant, Ns: Non significant
4. Significant parameters and its interaction: Y, T, S x Y, T x Y, T x S, T x S

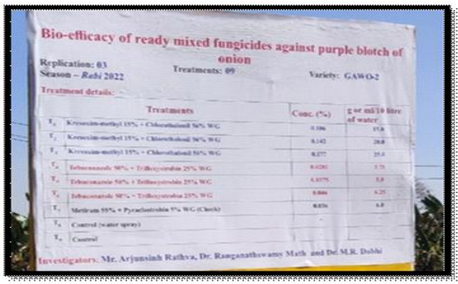

Fig. 1: Overview of experimental layout

Table 4 : Efficacy of fungicides on bulb yield of onion (pooled 2021-22 & 2022-23)

Tr. No	Treatment	Conc. (%)	Bulb yield (q/ha)		
			2021-22	2022-23	Pooled over years
T_1	Kresoxim-methyl 15% + Chlorothalonil 56% WG	0.106	575^{bc}	526^{bc}	551^{bc}
T_2	Kresoxim-methyl 15% + Chlorothalonil 56% WG	0.142	586^{ab}	536^{bc}	561^{b}
T_3	Kresoxim-methyl 15% + Chlorothalonil 56% WG	0.177	668^{a}	645^{a}	657^{a}
T_4	Tebuconazole 50% + Trifloxystrobin 25% WG	0.0281	569^{bc}	521^{bc}	545^{bc}
T_5	Tebuconazole 50% + Trifloxystrobin 25% WG	0.0375	563^{bc}	548^{bc}	556^{bc}
T_6	Tebuconazole 50% + Trifloxystrobin 25% WG	0.046	581^{bc}	586^{ab}	584^{b}
T_7	Metiram 55% + Pyraclostrobin 5% WG (Check)	0.036	609^{ab}	556^{abc}	583^{b}
T_8	Control (water spray)	-	525^{bc}	475^{c}	500^{cd}
T_9	Control	-	499^{c}	467^{c}	483^{d}
S.Em.±	Treatment (T)		25.49	80.42	17.17
	Year (Y)		-	-	8.72
	T X Y		-	-	26.16
	CD at 5% T		Sig.	Sig.	Sig.
	C.V. (%)		7.68	8.60	8.13

Note:

1. Treatment means with the letter(s) in common are not significant by DNMRT at 5% level of significance
2. Sig: Significant NS: non-significant
3. Significant parameters and its interaction: T, T x Y

Fig. 2: Symptoms of purple blotch of onion in the field

Fig. 3: Control (Left) and Treated (Kresoxim-methyl 15% + Chlorothalonil 56% WG, 0.177 %, 0.0375 %- Right) in the field

transport chain, specifically at the Qo site, disrupting energy production in the funguswhich is vital for fungal metabolism.While Chlorothalonil functions as a multi-site contact fungicide disrupting various fungal cell processes, including spore germination and membrane integrity.Essentially, this combination provides both systemic and contact control against a wide range of fungal pathogens.

CONCLUSION

From the above study the result indicate that all the treatments were found effective in controlling purple blotch of onion. Foliar spray with Kresoxim-methyl 15% + Chlorothalonil 56% WG @ 0.177 was found more effective for the management of purple blotch in onion.Two foliar sprays of Kresoxim-methyl 15% + Chlorothalonil 56% WG, 0.177 % (25 g per 10 litre of water) mixed with sticker 0.1% (10 ml per 10 litre of water), first at the appearance of disease and second spray at 10 days after first spray are effective in managing purple blotch in onion.

DECLARATION

Conflict of Interest. Authors declare no conflict of interest.

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