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Bioefficacy of Ametoctradin and Dimethmorph against Downy Mildew Disease of Cucumber

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A B S T R A C T

Downy mildew disease (DMD) of cucumber is destructive in nature and reduces fruit yield. Fungicides were used to control DMD but still DMD occurs. Hence, for the good alternative fungicide to control DMD, field experiment on efficacy of ametoctradin + dimethmorph against DMD was conducted in *rabi* and *kharif* season. There were 8 treatments with seven fungicides and control. Observations on per cent disease index (PDI), fruit yield and phytotoxicity of fungicides on cucumber were recorded. In *rabi* season, ametoctradin 300g/l + dimethomorph 225 g/l SC with 525g.a.i reduced PDI maximally (14.74 %) followed by zampro 525 SC (15.12%). In *kharif* season, ametoctradin 300g/l + dimethomorph 225 g/l SC with 525g.a.i reduced PDI maximally (13.63%) followed by zampro 525 SC (14.09%). In *rabi* and *kharif* season, ametoctradin 300g/1 + dimethomorph 225 g/1 SC with 525g.a.i treated plants produced significantly higher yield of cucumber fruits (23.33t/ha, 24.23t/ha) followed by zampro 525 SC (22.92t/ha, 23.00t/ha) over other fungicides. Ametoctradin 300 g/l + dimethomorph 225 g/l SC @ 1000 ml/ha and @ 2000 ml/ha were not toxic to cucumber plant in *rabi* and *kharif* season. The results concluded that use of ametoctradin 300g/l + dimethomorph 225 g/l SC with 525g.a.i resulted in reduced PDI and improved yield.

Introduction

Cucumber (*Cucumis sativus* L) is grown in Karnataka as important vegetable crop. Cucumber is infected by *Pseudoperonospora cubensis,* an obligate pathogen during its growth. This plant pathogen produces downy mildew disease (DMD) in cucumber which is destructive in nature and consequently reduces fruit yield of cucumber. Several fungicides have been tested to control DMD (Gupta and Shyam, 1998; Gupta *et al.,* 1993; Robak, 2001; Sharma *et al.,* 2003; Ferenc *et al.,* 2014) but still DMD occurs and causes reduction in yield and economic loss to the farmers. Hence, in order to find out the good alternative fungicide to control DMD, the field experiment on the efficacy of ametoctradin 300g/l + dimethmorph 225 g/l SC against downy mildew disease of cucumber was conducted.

Materials and Methods

Field experiment was conducted to study the efficacy of ametoctradin 300g/l + dimethmorph 225 g/l SC against downy mildew disease of cucumber in farmer's field

at Lakmagikoppal village in Ranebennur taluk, Haveri district during *rabi* season in the year 2015-16 and *Kharif* season in the year 2016-17. Cucumber variety used for the study was Ranebennur local. The soil type was red soil. The 30 days old cucumber plants were transplanted at the spacing of 90 cm x 75 cm. The plot size was 25 meter square. The cucumber crop was grown under irrigated condition. The experiment was conducted in randomized block design with 8 treatments and 3 replications. The treatments included were seven different fungicides along with untreated control.

Observations on fruit yield per plot were recorded. The data on disease severity and fruit yield were analysed statistically and presented.

The treatments were T1 (ametoctradin 300 g/l + dimethomorph 225 g/l SC with granules active ingredients (g.a.i) of 420 and dosage of 800g or ml/ ha), T2 (ametoctradin 300g/1 + dimethomorph 225 g/1 SC with g.a.i of 525 and dosage of 1000g or ml/ ha), T3 (zampro 525 SC g.a.i of 420 and dosage of 800g or ml/ ha), T4 (ametoctradin 25 % SC with g.a.i of 500 and dosage of 2500g or ml/ ha), T5 (dimethomorph 50% WP with g.a.i of 500 and dosage of 1000g or ml/ ha), T6 (cymoxanil 8% + mancozeb 64% WP with g.a.i of 1080 and dosage of 1500g or ml/ ha), T7 (mancozeb 75% WP with g.a.i of 1500 and dosage of 2000g or ml/ ha) and T8 (untreated control). Type of Sprayer used to spray fungicides was Knap sack sprayer fitted with flood jet. Cucumber crop was sprayed with fungicides at different stages of growth as per treatments. The first spray was given at flowering stage. Subsequent 3 sprays were given at the interval of 15 days during *rabi* season of 2015-16 and *kharif* season of 2016-17. Downy mildew disease severity was recorded in 5 plants for each plot at 30, 45 and 60 days after transplanting on 0-5 standard rating scale (0 – No infection, 1- 0 to 10, 2 – 10.1 to 15, 3 - 15.1 to 25, 4 – 25.1 to 50, 5 – more than 50 % area of infection) and the scale was converted into disease severity (Per cent Disease Index i.e. PDI) using the formula given by wheeler (1969).

$$PDI = \frac{\text{Sum of numerical values}}{\text{Number of plant observed}} \times \frac{100}{\text{Maximum disease rating value.}}$$

Phytotoxic effects of ametoctradin and dimethmorph

Field experiment was conducted in the field to study the phytotoxic effect of ametoctradin and dimethmorph on cucumber in *rabi* season in the year 2015-16 and *Kharif* season in the year 2016-17. The treatments included were T1: ametoctradin 300g/l + dimethmorph 225 g/l SC with g.a.i of 525 and dosage of 1000g or ml/ ha, T2: ametoctradin 300g/l + dimethmorph 225 g/l SC with g.a.i of 1050 and dosage of 2000g or ml/ ha and T3: untreated control with three replications. Phytotoxic symptoms of ametoctradin and dimethmorph such as leaf tips and surface injury, wilting, necrosis, epinasty and hyponasty on plants were observed on 1st day, 3rd day, 5th day, 7th day and 10th day after spray. The phytotoxic symptoms were recorded on 0-10 scale (0 – No phytotoxicity, 1 - 1-10, 2 - 11-20, 3 - 21-30, 4 - 31-40, 5 - 41-50, 6 - 51-60, 7 - 61-70, 8 - 71-80, 9 - 81-90 and 10 - 91-100 % phytotoxicity) (CIB 1989). For this five plants were selected at random from each treatment and the total number of leaves and those showing phyto-toxicty were counted.

Results and Discussion

Percent disease index

The results of the study showed that all the fungicidal treatments were found effective in reducing the disease index of downy mildew

in cucumber over untreated control in both *rabi* and *kharif* season (Tables 1 and 2; Fig. 1). In rabi season, ametoctradin 300g/l + dimethomorph 225 g/l SC with g.a.i of 525 and dosage of 1000g or ml/ ha was superior in reducing the disease index of DMD (14.74 % PDI) over the control, followed by zampro 525 SC with g.a.i of 525 and dosage of 1000g or ml/ ha (15.12% PDI).

The order of effectiveness of fungicides in disease reduction was ametoctradin 300g/1 + dimethomorph 225 g/1 SC with g.a.i of 525 and dosage of 1000g or ml/ ha (14.74 % PDI) > zampro 525 SC g.a.i of 525 and dosage of 1000g or ml/ ha (15.12 % PDI) > ametoctradin 300 g/l + dimethomorph 225 g/l SC with g.a.i of 420 and dosage of 800g or ml/ ha (16.23 % PDI) > dimethomorph 50% WP with g.a.i of 500 and dosage of 1000g or ml/ ha (18.51 % PDI) > mancozeb 75% WP with g.a.i of 1500 and dosage of 2000g or ml/ ha (21.80 % PDI) > cymoxanil 8% + mancozeb 64% WP with g.a.i of 1080 and dosage of 1500g or ml/ ha (22.11 % PDI) > ametoctradin 25 % SC with g.a.i of 500 and dosage of 2500g or ml/ ha (22.22 % PDI). Overall, data revealed that the efficacy of ametoctradin 300g/1 + dimethomorph 225 g/1 SC with g.a.i of 525 and dosage of 1000g or ml/ ha and zampro 525 SC g.a.i of 525 and dosage of 1000g or ml/ ha against DMD was found effective and superior comparable to dimethomorph 50% WP and cymoxanil 8%+ mancozeb 64 % WP.

The disease severity reduction due to application of fungicides noticed in *kharif* season of 2016-17 was of similar trend to that of in *rabi* season of 2015-16. All the fungicidal treatments were found effective in reducing the disease index of DMD in cucumber over control in *kharif* season. Among different fungicides, ametoctradin 300g/l + dimethomorph 225 g/l SC with g.a.i of 525 and dosage of 1000g or ml/ ha was superior in reducing the disease index of DMD (13.63% PDI) over the control, followed by zampro 525 SC with g.a.i of 525 and dosage of 1000g or ml/ ha (14.09% PDI).

The order of effectiveness of fungicides in disease reduction was ametoctradin 300g/1 + dimethomorph 225 g/1 SC with g.a.i of 525 and dosage of 1000g or ml/ ha (13.63 % mean PDI) > Zampro 525 SC g.a.i of 525 and dosage of 1000g or ml/ ha (14.09 % PDI) > ametoctradin 300 g/l + dimethomorph 225 g/l SC with g.a.i of 420 and dosage of 800g or ml/ ha (15.47% PDI) > dimethomorph 50% WP with g.a.i of 500 and dosage of 1000g or ml/ ha (17.40% PDI) > mancozeb 75% WP with g.a.i of 1500 and dosage of 2000g or ml/ ha (20.28% PDI) > cymoxanil 8% + mancozeb 64% WP with g.a.i of 1080 and dosage of 1500g or ml/ ha (21.52% PDI) > ametoctradin 25 % SC with g.a.i of 500 and dosage of 2500g or ml/ ha (22.22% PDI).

Overall, data revealed that the efficacy of ametoctradin 300g/1 + dimethomorph 225 g/1 SC with g.a.i of 525 and dosage of 1000g or ml/ ha and zampro 525 SC g.a.i of 525 and dosage of 1000g or ml/ ha against DMD was found effective and superior comparable to dimethomorph 50% WP and cymoxanil 8% + mancozeb 64 % WP in *kharif* season of 2016-17.

These findings were in agreement with results of previous experiments wherein fungicides used to control DMD (Thind *et al.*, 2009, Gupta and Jarial, 2014). Ametoctradin 300g/l +dimethomorph 225 g/l SC with g.a.i of 525 and dosage of 1000g or ml/ ha and zampro 525SC @1000 ml per ha against downy mildew disease was found effective and superior comparable to dimethomorph 50% WP and cymoxanil 8% + mancozeb 64 % WP.

Table.1 Bioefficacy of Ametoctradin 300 g/1 + Dimethomorph 225 g/1 SC against Downy mildew disease of cucumber in *rabi* season during 2015-16

Treatment Details		g a,I (Granules Active Ingredients)	Dosage/ha Formulation (g or ml)	Water volume (L)	Percent downy mildew diseases index (PDI)				Mean	Fruit yield (t/ha)
					Before spray	I spray	II spray	III spray		
T1	Ametoctradin 300 g/l + Dimethomorph 225 g/l SC	420	800	500	4.60 (12.38)	9.14 (17.59)	11.22 (19.57)	28.33 (32.16)	16.23	21.27
T2	Ametoctradin 300 g/l + Dimethomorph 225 g/l SC	525	1000	500	4.41 (12.12)	8.12 (16.55)	10.62 (19.01)	25.47 (30.30)	14.74	23.33
T3	Zampro 525 SC	525	1000	500	4.15 (11.75)	8.43 (16.84)	10.85 (19.43)	26.10 (30.92)	15.12	22.92
T4	Ametoctradin 25 % SC	500	2500	500	4.41 (12.27)	12.65 (20.55)	17.71 (24.83)	36.32 (37.11)	22.22	12.00
T5	Dimethomorph 50% WP	500	1000	500	4.40 (12.11)	10.20 (18.62)	15.31 (23.03)	30.02 (33.22)	18.51	22.00
T6	Cymoxanil 8% + Mancozeb 64% WP	1080	1500	500	4.48 (12.22)	12.68 (20.86)	15.82 (23.43)	37.83 (37.95)	22.11	13.01
T7	Mancozeb 75% WP	1500	2000		4.49 (12.23)	11.66 (19.96)	17.97 (25.08)	35.77 (36.73)	21.80	12.03
T8	Untreated Control	-	-	-	4.68 (12.50)	24.77 (29.84)	41.35 (40.01)	61.45 (51.61)	42.52	9.13
	SEm±				0.42	1.03	1.32	2.26		0.16
	CD(0.05)				1.30	3.18	4.08	6.98		0.51

Figures in parenthesis indicate arcsine values.

Table.2 Bioefficacy of Ametoctradin 300 g/1 + Dimethomorph 225 g/1 SC against Downy mildew disease of cucumber in *kharif* season during 2016-17

Treatment Details		g a,I (Granules Active Ingredients)	Dosage/ha Formulation (g or ml)	Water volume (L)	Percent diseases index (PDI)				Mean PDI	Fruit yield (t/ha)
					Before spray	I spray	II spray	III spray		
T1	Ametoctradin 300g/1 + Dimethomorph 225 g/1 SC	420	800	500	3.70 (11.09)	8.30 (16.74)	10.90 (19.28)	27.20 (31.43)	15.47	21.60
T2	Ametoctradin 300g/1 + Dimethomorph 225 g/1 SC	525	1000	500	3.50 (10.78)	7.37 (15.75)	9.18 (17.64)	24.33 (29.55)	13.63	24.23
T3	Zampro 525 SC	420	800	500	3.63 (10.98)	8.85 (16.99)	10.43 (18.93)	25.00 (30.45)	14.09	23.00
T4	Ametoctradin 25 % SC	500	2500	500	3.65 (11.20)	12.24 (20.24)	18.33 (25.10)	36.10 (37.23)	22.22	12.20
T5	Dimethomorph 50% WP	500	1000	500	3.59 (10.93)	9.17 (17.62)	14.10 (22.05)	28.93 (32.54)	17.40	22.33
T6	Cymoxanil 8% Mancozeb 64% WP	1080	1500	500	3.60 (10.94)	11.63 (19.94)	17.53 (24.75)	35.40 (36.51)	21.52	13.30
T7	Mancozeb 75% WP	1500	2000		3.57 (10.88)	10.17 (18.59)	16.20 (23.73)	34.47 (35.95)	20.28	12.73
T8	Untreated Control				3.70 (11.09)	23.10 (28.72)	39.77 (39.09)	59.97 (50.74)	40.95	9.50
	SEm±				0.20	0.70	1.22	1.85		0.38
	CD(0.05)				0.65	2.14	3.77	5.69		1.17

Figures in parenthesis indicate arcsine values

Table.3 Phytotoxicity effect of Ametoctradin + Dimethomorph on cucumber grown in field in *rabi* season of 2015-16

Day of observation after spray	Treatment Details	Phytotoxicity Symptoms				
		Leaf tips and surface injury	Wilting	Vein clearing	Necrosis	Epinasty and hyponasty
1st Day	T-1 Ametoctradin 300 g/l + Dimethomorph 225 g/l SC @ 1000 ml/ha	NP	NP	NP	NP	NP
	T-2 Ametoctradin 300 g/l + Dimethomorph 225 g/l SC @ 2000 ml/ha	NP	NP	NP	NP	NP
	T-3 Untreated control	NP	NP	NP	NP	NP
3rd Day	T-1 Ametoctradin 300 g/l + Dimethomorph 225 g/l SC @ 1000 ml/ha	NP	NP	NP	NP	NP
	T-2 Ametoctradin 300 g/l + Dimethomorph 225 g/l SC @ 2000 ml/ha	NP	NP	NP	NP	NP
	T-3 Untreated control	NP	NP	NP	NP	NP
5th Day	T-1 Ametoctradin 300 g/l + Dimethomorph 225 g/l SC @ 1000 ml/ha	NP	NP	NP	NP	NP
	T-2 Ametoctradin 300 g/l + Dimethomorph 225 g/l SC @ 2000 ml/ha	NP	NP	NP	NP	NP
	T-3 Untreated control	NP	NP	NP	NP	NP
7th Day	T-1 Ametoctradin 300 g/l + Dimethomorph 225 g/l SC @ 1000 ml/ha	NP	NP	NP	NP	NP
	T-2 Ametoctradin 300 g/l + Dimethomorph 225 g/l SC @ 2000 ml/ha	NP	NP	NP	NP	NP
	T-3 Untreated control	NP	NP	NP	NP	NP
10th Day	T-1 Ametoctradin 300 g/l + Dimethomorph 225 g/l SC @ 1000 ml/ha	NP	NP	NP	NP	NP
	T-2 Ametoctradin 300 g/l + Dimethomorph 225 g/l SC @ 2000 ml/ha	NP	NP	NP	NP	NP
	T-3 Untreated control	NP	NP	NP	NP	NP

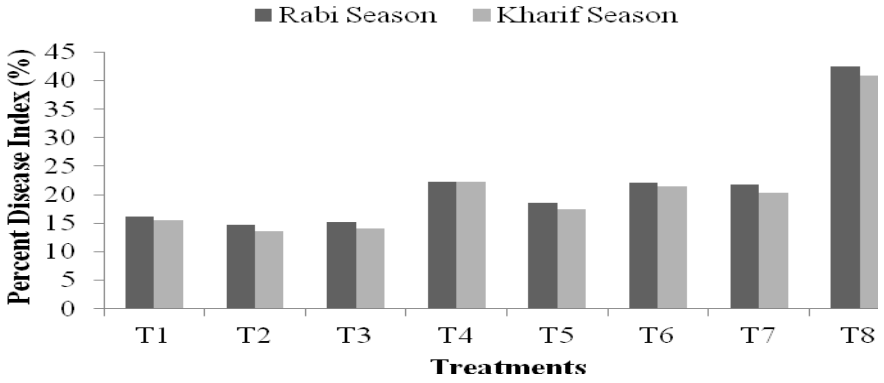
NP: No Pyhtotoxicity

Table.4 Phytotoxicity effect of Ametoctradin + Dimethomorph on cucumber grown in field in *kharif* season of 2016-17

Day of observation after spray	Treatment Details	Phytotoxicity Symptoms				
		Leaf tips and surface injury	Wilting	Vein clearing	Necrosis	Epinasty and hyponasty
1st Day	T-1 Ametoctradin 300 g/l + Dimethomorph 225 g/l SC @ 1000 ml/ha	NP	NP	NP	NP	NP
	T-2 Ametoctradin 300 g/l + Dimethomorph 225 g/l SC @ 2000 ml/ha	NP	NP	NP	NP	NP
	T-3 Untreated control	NP	NP	NP	NP	NP
3rd Day	T-1 Ametoctradin 300 g/l + Dimethomorph 225 g/l SC @ 1000 ml/ha	NP	NP	NP	NP	NP
	T-2 Ametoctradin 300 g/l + Dimethomorph 225 g/l SC @ 2000 ml/ha	NP	NP	NP	NP	NP
	T-3 Untreated control	NP	NP	NP	NP	NP
5th Day	T-1 Ametoctradin 300 g/l + Dimethomorph 225 g/l SC @ 1000 ml/ha	NP	NP	NP	NP	NP
	T-2 Ametoctradin 300 g/l + Dimethomorph 225 g/l SC @ 2000 ml/ha	NP	NP	NP	NP	NP
	T-3 Untreated control	NP	NP	NP	NP	NP
7th Day	T-1 Ametoctradin 300 g/l + Dimethomorph 22 5 g/l SC @ 1000 ml/ha	NP	NP	NP	NP	NP
	T-2 Ametoctradin 300 g/l + Dimethomorph 225 g/l SC @ 2000 ml/ha	NP	NP	NP	NP	NP
	T-3 Untreated control	NP	NP	NP	NP	NP
10th Day	T-1 Ametoctradin 300 g/l + Dimethomorph 225 g/l SC @ 1000 ml/ha	NP	NP	NP	NP	NP
	T-2 Ametoctradin 300 g/l + Dimethomorph 225 g/l SC @ 2000 ml/ha	NP	NP	NP	NP	NP
	T-3 Untreated control	NP	NP	NP	NP	NP

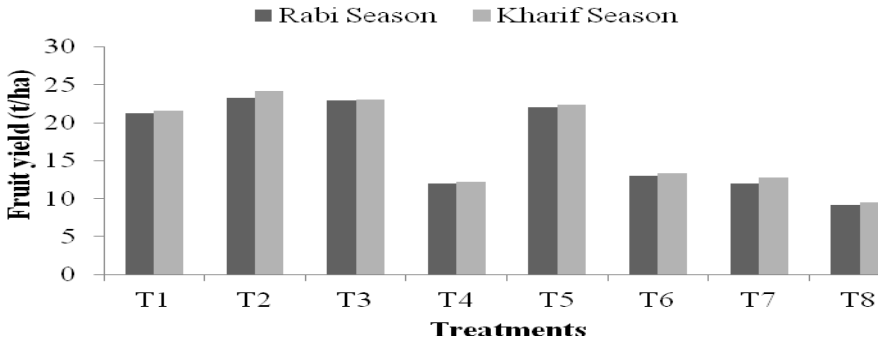
NP: No Pyhtotoxicity

Fig.1 Bioefficacy of ametoctradin and dimethmorph against downy mildew disease of cucumber on percent disease index grown during *rabi* and *kharif* season of 2015-16 and 2016-17



Note:
T1: Ametoctradin 300 g/l + Dimethomorph 225 g/l SC with g.a.i of 420 and dosage of 800g or ml/ ha
T2: Ametoctradin 300g/1 + Dimethomorph 225 g/1 SC with g.a.i of 525 and dosage of 1000g or ml/ ha
T3: Zampro 525 SC g.a.i of 420 and dosage of 800g or ml/ ha
T4: Ametoctradin 25 % SC with g.a.i of 500 and dosage of 2500g or ml/ ha
T5: Dimethomorph 50% WP with g.a.i of 500 and dosage of 1000g or ml/ ha
T6: Cymoxanil 8% Mancozeb 64% WP with g.a.i of 1080 and dosage of 1500g or ml/ ha
T7: Mancozeb 75% WP with g.a.i of 1500 and dosage of 2000g or ml/ ha
T8: Untreated Control

Fig.2 Bioefficacy of ametoctradin and dimethmorph against downy mildew disease on fruit yield of cucumber grown during *rabi* and *kharif* season of 2015-16 and 2016-17



Note:
T1: Ametoctradin 300 g/l + Dimethomorph 225 g/l SC with g.a.i of 420 and dosage of 800g or ml/ ha
T2: Ametoctradin 300g/1 + Dimethomorph 225 g/1 SC with g.a.i of 525 and dosage of 1000g or ml/ ha
T3: Zampro 525 SC g.a.i of 420 and dosage of 800g or ml/ ha
T4: Ametoctradin 25 % SC with g.a.i of 500 and dosage of 2500g or ml/ ha
T5: Dimethomorph 50% WP with g.a.i of 500 and dosage of 1000g or ml/ ha
T6: Cymoxanil 8% Mancozeb 64% WP with g.a.i of 1080 and dosage of 1500g or ml/ ha
T7: Mancozeb 75% WP with g.a.i of 1500 and dosage of 2000g or ml/ ha
T8: Untreated Control

Though, cymoxanil 8% + mancozeb 64 % WP and dimethomorph 50% WP, were not so effective comparatively in the present study, were reported to control the disease with an average disease severity of 2.6% and 5.0% respectively (Thind *et al.,* 2009).

In another similar study, among seven fungicides [Amistar (azoxystrobin), Curzate (cymoxanil + mancozeb), Ridomil MZ (metalaxyl +mancozeb), Blitox-50 (copper oxychloride), Indofil M-45 (mancozeb), Companion (mancozeb +carbendazim) and Shield] tested on cucumber against downy mildew, Ridomil MZ was found the best in the disease control up to maximum level (73.75%) during both the years with lowest disease severity value of 16.11 per cent (Gupta and Jarial, 2014). The poor performance of dimethomorph 50% WP and cymoxanil 8% + mancozeb 64 % WP in reducing disease severity in the present investigation could be due to resistance of pathogen to these fungicides.

Phyto-toxicty study

Phyto-toxicty studies of ametoctradin 300 g/l + dimethomorph 225 g/l SC @ 1000 ml/ha and ametoctradin 300 g/l + Dimethomorph 225 g/l SC @ 2000 ml/ha revealed that these were not toxic to cucumber plant in both *rabi* and *kharif* season (Tables 3 and 4). There were no visual symptoms of phyto-toxicty in terms of leaf tips and surface injury, wilting, necrosis, epinasty and hyponasty on cucumber crops treated with ametoctradin 300 g/l + dimethomorph 225 g/l SC @ 1000 ml/ha, ametoctradin 300 g/l + dimethomorph 225 g/l SC @ 2000 ml/ha on 1st day, 3rd day, 5th day, 7th day and 10th day after spray. This study indicated that ametoctradin 300 g/l + dimethomorph 225 g/l SC @ 1000 ml/ha and ametoctradin 300 g/l + dimethomorph 225 g/l SC @ 2000 ml/ha can be used to control DMD of cucumber safely without being toxic to plant. The similar observations on fungicidal phyto-toxicty were reported in previous experiments (Ranganathan, 2001 and Sendhil Vel *et al.,* 2004)

Cucumber fruit yield

The reduction in disease severity due to application of fungicides was reflected in increased fruit yield of cucumber (Tables 1 and 2; Fig. 2). Cucumber plants treated with fungicides produced significantly higher yield compared to untreated control plants in both *rabi* and *kharif* season. The increased fruit yield due to fungicide application in *rabi* season of 2015-16 was 23.33 (ametoctradin 300g/1 + dimethomorph 225 g/1 SC with g.a.i of 525 and dosage of 1000g or ml/ ha),22.92 (zampro 525 SC g.a.i of 420 and dosage of 800g or ml/ ha) 22.00 (dimethomorph 50% WP with g.a.i of 500 and dosage of 1000g or ml/ ha), 21.27 (ametoctradin 300 g/l + dimethomorph 225 g/l SC with g.a.i of 420 and dosage of 800g or ml/ ha), 13.01 (cymoxanil 8% + mancozeb 64% WP with g.a.i of 1080 and dosage of 1500g or ml/ ha) 12.03(mancozeb 75% WP with g.a.i of 1500 and dosage of 2000g or ml/ ha) 12.00 t/ha (ametoctradin 25 % SC with g.a.i of 500 and dosage of 2500g or ml/ ha) over the untreated control 9.13 t/ha.

In *kharif* season of 2016-17 also, similar trend that of *rabi* of 2015-16 in the increased fruit yield due to fungicide treatment was observed. The increased yield due to fungicide application in kharif season was 24.23 (ametoctradin 300g/1 + dimethomorph 225 g/1 SC with g.a.i of 525 and dosage of 1000g or ml/ ha), 23.00 (zampro 525 SC g.a.i of 420 and dosage of 800g or ml/ ha), 22.33 (zimethomorph 50% WP with g.a.i of 500 and dosage of 1000g or ml/ ha), 21.60 (ametoctradin 300 g/l + dimethomorph 225 g/l SC with g.a.i of 420 and dosage of 800g or ml/ ha), 13.30 (cymoxanil 8% + mancozeb 64% WP with g.a.i of 1080 and dosage of 1500g or ml/ ha), 12.73(mancozeb 75% WP with g.a.i of 1500 and dosage of 2000g or ml/ ha) 12.20 t/ha (ametoctradin 25 % SC with g.a.i of 500 and dosage of 2500g or ml/ ha) over the untreated control 9.13 t/ha 9.50 t/ha.

Overall, data revealed that the efficacy of ametoctradin 300g/l + dimethomorph 225 g/l SC @ 1000 ml per ha followed by zampro 525 SC@ 1000 ml per ha were found effective and superior in increasing the cucumber fruit yield due to reduction of PDI comparable to dimethomorph 50% WP and cymoxanil 8% + mancozeb 64 % WP. The increased fruit yield

due to fungicide application was due to control of DMD which might have resulted in better development of foliage of cucumber and consequently higher fruit yield in plants treated with fungicides. These results were in agreement with previous experiments wherein the increased fruit yield of cucumber in plants treated with fungicides was reported (Khetmalas and Memane, 2003 and Gupta and Jarial, 2014). Among seven fungicides [Amistar (azoxystrobin), Curzate (cymoxanil + mancozeb), Ridomil MZ (metalaxyl +mancozeb), Blitox-50 (copper oxychloride), Indofil M-45 (mancozeb), Companion (mancozeb +carbendazim) and Shield] tested on cucumber against downy mildew, Ridomil MZ resulted in maximum fruit yield during both the years (Gupta and Jarial, 2014). Hence this study concluded that use of fungicide ametoctradin 300g/l + dimethomorph 225 g/l SC @ 1000 ml per ha reduced the disease severity and improved the yield. This information could be used in disease management program for controlling downy mildew of cucumber.

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