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Evaluation on the Efficacy of Modern Fungicides against Rice Diseases

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Abstract

The modern broad spectrum fungicides *viz.,* trifloxystrobin 25% + tebuconazole 50 %, kresoxim methyl and azoxystrobin were tested along with previously recommended fungicides like tricyclazole, carbendazim and propiconazole against rice diseases. Three sprays of fungicide combination *viz.,* trifloxystrobin 25% + tebuconazole 50 % (0.04 %) at 15 days interval starting first spray immediately after disease appearance were found to be most effective in management of leaf blast, neck blast, node blast, sheath rot, leaf scald, brown spot and seed discolouration diseases and thereby enhancing the grain yield in paddy. This was followed by tricyclazole (0.06 %), propiconazole (0.10 %) and carbendazim (0.10%).

Keywords: Rice, diseases, fungicides.

Introduction

Rice is the most important staple food grain for more than two billion people living in the rural and urban areas of humid and sub-humid Asia. It accounts for 30 to 50 per cent of agricultural production and 50–90 per cent of the calories consumed by these people (Hossain and Fischer, 1995). Rice provides household and national food security and generates employment and incomes for the low-income groups in these areas. However, the biotic causes like diseases and pests are causing huge losses to the rice crop.

In Maharashtra, the productivity of rice is 1800 kg/ha, which is less than the national level (2410 kg/ha) (Anonymous, 2014). In Maharashtra, the rice is infected by diseases *viz.,* leaf and neck blasts (*Pyricularia grisea*), leaf scald (*Rhynchosporium oryzae*), sheath rot (*Sarocladium oryzae*), brown spot (*Dreschlera oryzae*) and grain discolouration (Spp. of *Dreschlera, Sarocladium, Pyricularia,* etc.), which became the major production constraint in all rice-growing areas of the state. The average losses caused by the diseases are in between 10 to 30 per cent. However, if all these diseases appear simultaneously then huge losses ranging from 30 to 100 per cent may be caused in the susceptible varieties.

Unfortunately, varieties are not available with multiple disease resistance. Hence, there is no alternative for management of diseases by chemicals. However, the farmers failed to control the diseases by spraying the traditional chemicals having no or less broad spectrum activity. Hence, looking in to the importance of the crop as well as severity of diseases appearing on it and need of the farmers, the trials were conducted with new broad spectrum fungicides.

Materials and Methods

The field experiments were conducted at Agricultural Research Station, Lonavala, Tal. – Maval, Dist. – Pune (MS) for consecutive two years during the *kharif* seasons of 2012 and 2013 in RBD design with four replications. The modern broad spectrum fungicides *viz.,* trifloxystrobin 25% [Methyl (E) - methoxyimino - {(E) - α - [1 - (α, α, α - trifluorom-tolyl) ethylideneaminooxy] - o - tolyl} acetate] + tebuconazole 50 % [(RS) - 1 - p - chlorophenyl) - 4, 4 - dimethyl - 3 - (1H - 1, 2, 4 - triazol - 1- ylmethyl) pentan-3-ol] *i.e.* Nativo, kresoxim methyl *i.e.* Ergon [methyl (2E) - (methoxyimino) {[(2 - methylphenoxy) methyl] phenyl}acetate], and azoxystrobin *i.e.* Mirador [Methyl (E) - 2 - {2 - [6 - (2 - cyanophenoxy) pyrimidin - 4 - yloxy]phenyl}-3-methoxyacrylate] were tested along with previously recommended fungicides like tricyclazole *i.e.* Blastogan (5 - methyl - 1, 2, 4 - triazol [3, 4, - b] [1, 3] benzothiazole), carbendazim *i.e.* Benmain (2- (Methoxy-carbamoyl) benzimidazole) and propiconazole *i.e.* Bumper (1 - [2 - (2, 4 - dichlorophenyl) - 4 - porpyl - 1, 3 - dioxolan-2 - yl - methyl] - 1H - 1, 2, 4 - trizole).

The highly susceptible variety of paddy, 'EK – 70' was transplanted under rainfed lowland condition in plots of 5.30 × 2.30 m^2 for each of the treatment at 0.15 m row to row and plant to plant distance. The crop was fertilized with 50:50:50 kg NPK/ha as basal dose and top dressed with 50 kg N/ha one month after transplanting. The first spray of fungicides was taken immediately after appearance of any pathogen (*i.e. Pyricularia grisea*) and was followed by two sprays at 15 days interval thereafter. For all diseases common spray schedule was followed. The observations for incidence / severity of different diseases were recorded as per SES scale (Anonymous, 2002) and for grain yield (kg/net plot) at maturity stage.

Per cent disease incidence and intensity were calculated by the formula:

$$\text{Incidence} = \frac{\text{No. of leaves infected}}{\text{Total No. of leaves examined}} \times 100$$

$$\text{PDI} = \frac{\text{Total numerical rating}}{\text{Total No. of leaves examined X Maximum rating (}i.e.\text{ 7 rating)}} \times 100$$

Results and Discussion

Leaf blast

The leaf blast data (Table 1) indicated that the treatment differences due to fungicides were statistically significant. The lowest incidence (33.28 %) and intensity (14.09 %) of leaf blast were noticed in the treatment with trifloxystrobin 25 % + tebuconazole 50 % (0.04 %) that showed highest disease reduction of 70.63 per cent. While, it was at par with tricyclazole (0.06 %) and propiconazole (0.10%) those recorded 62.85 and 59.70 per cent leaf blast reduction over control, respectively. The untreated control had significantly highest incidence of 75.71 per cent and severity of 47.95 per cent of the disease.

Neck and node blasts

The observations in Tables 1 and 2 divulge that the treatment differences in respect of neck and node blasts due to fungicides were statistically significant. The fungicide treatment with trifloxystrobin + tebuconazole (0.04 %) had significantly least incidence of 26.88 and 23.98 per cent of neck and node blasts and thus recorded highest disease control of 60.19 and 60.88 per cent of these diseases, respectively. This was followed by tricyclazole (0.06 %) that recorded 47.41 per cent neck blast and 50.79 per cent node blast reduction over control. The next fungicides in order of superiority were carbendazim (0.10 %) and propiconazole (0.10%), which showed 46.67 and 40.74 per cent neck blast while, 48.0 and 45.07 per cent node blast control, respectively. The control treatment showed significantly highest neck (67.50 %) and node (61.31 %) blast incidence.

Narayana Swamy *et al.* (2009) also reported the most effectiveness of trifloxystrobin + tebuconazole and tricyclazole against blast of rice. In addition, the data supports the findings of (Rohilla and Singh 1999) and corroborates the findings of (Vishwanathan and Narayanaswamy 1991). However, they did not notice the good control of blast with propiconazole.

Sheath rot

The treatment differences (Table 2) due to fungicides in respect of sheath rot were statistically significant. The treatment with trifloxystrobin + tebuconazole (0.04 %) had lowest sheath rot incidence (71.0 %) and intensity (27.56 %) and thereby recorded maximum disease reduction of 55.03 per cent. But, it was at par with most of the fungicides *viz.*, azoxystrobin (0.10 %), kresoxim methyl (0.10%), carbendazim (0.10 %) and propiconazole (0.10%), which showed 51.55, 50.32, 47.24 and 44.97 per cent reduction in the disease over control, respectively.

Leaf scald

The leaf scald observations reported in Table 3 indicate that the treatment differences due to fungicides were statistically significant. The lowest incidence of 22.52 per cent and intensity of 7.37 per cent of leaf scald was noticed in the treatment with trifloxystrobin + tebuconazole (0.04 %) that showed highest disease reduction of 81.09 per cent. While, it was at par with carbendazim (0.10 %), which recorded 73.47 per cent leaf scald reduction. The untreated control had significantly highest incidence and severity of 60.93 and 38.98 per cent, respectively.

Brown spot

The brown spot observations (Table 3) illustrated that the treatment differences due to fungicides were statistically significant. The fungicide trifloxystrobin + tebuconazole (0.04 %) showed least brown spot incidence and intensity of 62.13 and 14.38 per cent, respectively and thus highest disease reduction of 72.17 per cent. However, it was at par with azoxystrobin (0.10 %) and propiconazole (0.10 %) those recorded 65.69 and 64.18 per cent brown spot reduction, respectively. The untreated control had significantly highest incidence and severity of 96.88 and 51.65 per cent, respectively.

Seed / Glume Discolouration

The observations of seed / glume discolouration (Table 4) depicted that the treatment differences due to fungicides were statistically significant. The lowest incidence of 25.13 per cent with highest decrease of 51.80 per cent in seed discolouration was noticed in the treatment with trifloxystrobin + tebuconazole (0.04 %). Whereas, it was at par with azoxystrobin (0.10 %) that recorded 41.01 per cent reduction in disease over control. The highest seed discolouration of 52.13 per cent was noticed in untreated control.

Yield

The yield data presented in Table 4 were statistically significant. The significantly highest grain yield (35.08 q/ha) with 55.44 per cent increase was obtained in treatment with trifloxystrobin + tebuconazole (0.04 %). While, it was at par with tricyclazole (0.06 %), propiconazole (0.10 %), carbendazim (0.10%) and azoxystrobin (0.10%) wherein, 47.72, 42.16, 36.04 and 33.15 per cent increase in yield was reported, respectively. The untreated control plot yielded just 22.57 q/ha.The results are exactly matching with the findings of earlier work at DRR (IIRR), Hyderabad

(Anonymous, 2012) wherein they reported that the fungicide combination trifloxystrobin 25% + tebuconazole 50 % reduced the diseases *viz.*, leaf blast, neck blast, node blast, sheath rot, sheath blight, leaf scald, brown spot, false smut and seed discolouration and increased the yield of paddy to the greater extent. They also reported the effectiveness of tricyclazole, propiconazole and carbendazim. Further, (Kumar *et al*. 2013) also noticed the effectiveness of fungicides like carbendazim and tricyclazole in management of rice diseases and thereby increase in yield.

Conclusion

Three sprays of fungicide combination *viz.*, trifloxystrobin 25% + tebuconazole 50 % @ 0.04 per cent at 15 days interval starting first spray immediately after disease appearance were found to be most effective in management of leaf blast, neck blast, node blast, sheath rot, leaf scald, brown spot and seed discolouration diseases and thereby enhancing the grain yield in paddy. This was followed by tricyclazole (0.06 %), propiconazole (0.10 %) and carbendazim (0.10%).

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Table 1: Efficacy of new fungicides against leaf and neck blasts of paddy (Pooled results of 2012 & 2013)

Sr. No.	Name of fungicide	Dose (%)	Leaf blast (%)			Neck blast (%)	
			Incidence	PDI	Reduction over control	Incidence	Reduction over control
1	Trifloxystrobin 25 % + Tebuconazole 50 %	0.04	33.28 **35.2**	14.09 **22.02**	70.63	26.88 **31.09**	60.19
2	Kresoxim methyl	0.1	53.22 **46.86**	28.14 **31.97**	41.32	49.00 **44.42**	27.41
3	Azoxystrobin	0.1	46.02 **42.71**	24.43 **29.58**	49.05	45.85 **42.62**	32.07
4	Tricyclazole	0.06	35.90 **36.79**	17.81 **24.93**	62.85	35.50 **36.56**	47.41
5	Carbendazim	0.1	40.87 **39.73**	21.34 **27.48**	55.49	36.00 **36.87**	46.67
6	Propiconazole	0.1	38.51 **38.32**	19.32 **25.95**	59.70	40.00 **39.22**	40.74
7	Control	-	75.71 **60.50**	47.95 **43.82**	0.00	67.50 **55.31**	0.00
	SE ± CD (0.05)	-	1.36 4.05	1.25 3.81	-	1.57 4.67	-

The figures in the bold faces are arc sin values

Table 2: Efficacy of new fungicides against node blast and sheath rot of paddy (Pooled results of 2012 & 2013)

Sr. No.	Name of fungicide	Dose (%)	Node blast (%)		Sheath rot (%)		
			Incidence	Reduction over control	Incidence	PDI	Reduction over control
1	Trifloxystrobin 25 % + Tebuconazole 50 %	0.04	23.98 **21.31**	60.88	71.00 **57.47**	27.56 **31.6**	55.03
2	Kresoxim methyl	0.1	43.75 **41.4**	28.65	76.00 **60.8**	30.44 **33.38**	50.32
3	Azoxystrobin	0.1	38.94 **38.6**	36.49	74.00 **59.36**	29.44 **32.84**	51.95
4	Tricyclazole	0.06	30.17 **31.3**	50.79	81.50 **64.75**	39.00 **38.57**	36.36
5	Carbendazim	0.1	31.88 **34.35**	48.00	76.50 **61.34**	32.33 **34.65**	47.24
6	Propiconazole	0.1	33.68 **35.46**	45.07	76.50 **61.03**	33.72 **35.48**	44.97
7	Control	-	61.31 **51.54**	0.00	100.00 **85.95**	61.28 **51.53**	0.00
	SE ±		0.81		1.89	1.57	
	CD (0.05)		2.41		5.61	4.66	

The figures in the bold faces are arc sin values

Table 3: Efficacy of new fungicides against leaf scald and brown spot diseases of paddy (Pooled results of 2012 & 2013)

Sr. No.	Name of fungicide	Dose (%)	Leaf scald (%)			Brown spot (%)		
			Incidence	PDI	Reduction over control	Incidence	PDI	Reduction over control
1	Trifloxystrobin 25 % + Tebuconazole 50 %	0.04	22.52 **28.32**	7.37 **15.73**	81.09	62.13 **52.08**	14.38 **22.15**	72.17
2	Kresoxim methyl	0.1	44.64 **41.92**	24.92 **29.92**	36.08	69.00 **56.3**	18.75 **25.63**	63.70
3	Azoxystrobin	0.1	39.14 **38.72**	19.17 **25.86**	50.82	66.25 **54.5**	17.72 **24.86**	65.69
4	Tricyclazole	0.06	27.53 **31.57**	10.82 **19.15**	72.25	73.38 **59.17**	21.83 **27.83**	57.73
5	Carbendazim	0.1	24.64 **29.73**	10.34 **18.7**	73.47	86.50 **68.77**	33.49 **35.32**	35.17
6	Propiconazole	0.1	31.94 **34.39**	13.78 **21.78**	64.66	68.50 **55.87**	18.50 **25.45**	64.18
7	Control	-	60.93 **51.33**	38.98 **38.63**	0.00	96.88 **80.77**	51.65 **95.45**	0.00
	SE ±		1.06	0.87		2.16	1.12	
	CD (0.05)		3.13	2.58		6.41	3.32	

The figures in the bold faces are arc sin values

Table 4: Efficacy of new fungicides against glume discolouration and grain yield influenced by management of different diseases by these fungicides (Pooled results of 2012 & 2013)

Sr. No.	Name of fungicide	Dose (%)	Grain discolouration (%)		Grain yield	
			Incidence	Reduction over control	q/ha	Increase over control
1	Trifloxystrobin 25 % + Tebuconazole 50 %	0.04	25.13 **30.07**	51.80	35.08	55.44
2	Kresoxim methyl	0.1	31.88 **34.36**	38.85	27.30	20.95
3	Azoxystrobin	0.1	30.75 **33.64**	41.01	30.05	33.15
4	Tricyclazole	0.06	38.13 **38.05**	26.87	33.34	47.72
5	Carbendazim	0.1	32.88 **34.97**	36.94	30.71	36.04
6	Propiconazole	0.1	35.25 **36.42**	32.38	32.08	42.16
7	Control	-	52.13 **46.22**	0.00	22.57	0.00
	SE $\pm$		1.33		1.72	
	CD (0.05)		3.95		5.11	

The figures in the bold faces are arc sin values