

A combination fungicide for the management of blast and sheath blight disease of paddy

D. Pramesh ^{*1&2}, Maruti ^{1&2}, K.M. Muniraju ^{1&2}, K. Mallikarjun ², G.S. Guruprasad ¹, K. Mahantashivayogayya ¹, B.G.M. Reddy ¹, And S.B. Gowdar ².

¹All India Coordinated Rice Improvement Programme, Agricultural Research Station, Gangavathi, Karnataka, India.

²Department of Plant Pathology, University of Agricultural Sciences, Raichur, Karnataka, India.

*Author for correspondence

Email: parmi.iari@gmail.com

Short Title: Disease management in paddy

Key words: Rice, Blast, Sheath Blight, Trifloxystrobin 25% + Tebuconazole 50%, PDI

Authors' contributions

This work was carried out in collaboration between all authors. Author DP designed the study, conducted the field experiments. Authors M & KMM performed the statistical analysis and wrote the first draft of the manuscript. Authors KM, GSG, KM, BGMR and SBG reviewed the experimental design and all drafts of the manuscript. All authors read and approved the final manuscript.

Abstract

A new combination fungicide Nativo 75WG composed of Trifloxystrobin 25% (Strobilurin) and Tebuconazole 50% (Triazole) was tested against rice blast and sheath blight diseases under field conditions during *Autumn* 2014 and -2015. The combination fungicide Trifloxystrobin 25% + Tebuconazole 50% (Nativo 75 WG) @ 0.4 g/l was found effective against blast and sheath blight diseases recording least Percent Disease Index (PDI) of 17.02 and 24.7 respectively. Other combination fungicide Tricyclazole 18% + Mancozeb 62% WP @ 1.5 g/l recorded blast PDI of 26.03 which is statistically on par with Kresoxim methyl 44.3 SC @ 1.0 ml/l and Tricyclazole 75 WP @ 0.6 g/l. Other fungicides of the experiment such as Thifluzamide 24 SC @ 0.75 ml/l, Hexaconazole 4% + Zineb 68% @ 2.0g/l and Carbendazim 12% + Mancozeb 63% WP @ 2.0 g/l are on par among themselves but stands next to the Trifloxystrobin 25% + Tebuconazole 50% (Nativo 75 WG) @ 0.4 g/l in reducing sheath blight PDI. Significant increase in the grain yield was observed in the plots treated with test chemical Nativo 75 WG @ 0.4 g/l (55.13 q/h) compared to the other fungicidal treatments which recorded the yield in the range of 40.75 to 48.12 q/h.

Key words: Rice, Blast, Sheath Blight, Trifloxystrobin 25% + Tebuconazole 50%, PDI

1. Introduction

Rice (*Oryza sativa* L.) is an important food crop of the world including India. Ever growing population in the world particularly in India is further demanding more rice production and continuous reduction in the availability of cultivable land demanding higher productivity. Under field condition, the productivity of rice is affected by many biotic and abiotic factors. Among the different biotic constraints, diseases caused by fungal pathogens such as blast and sheath blight are more frequent and ferocious disease in irrigated rice of both temperate and subtropical areas and which cause damage at all stages of crop growth [1].

67 Rice blast caused by *Pyricularia oryzae* Cavara [synonym *Pyricularia grisea* Sacc.
68 the anamorph of *Magnaporthe grisea* (Herbert) Yaegashi and Udagawa], is one of the most
69 destructive and wide spread disease of rice [2]. Blast epidemic causes the complete defeat of
70 seedling [3] at the nursery and in field condition [4] and causes up to 80% of total yield
71 reduction [5-6]. Sheath blight, caused by *Rhizoctonia solani* Kunh., is an important
72 destructive disease of rice occurs in all rice growing areas of the world [7-10]. In India, a
73 modest estimation of losses due to the sheath blight disease alone has been up to 54.3% [11,
74 12]. The disease is particularly important in intensive rice production systems due to excess
75 use of nitrogenous fertilizers [13]. Yield losses of 5-10% have been estimated for tropical
76 lowland rice varieties such as PSBRc4, C4-137, IRW, IR74 and IR72 in Asia [9].

77 Fungicide based management of blast and sheath blight diseases is successful at field
78 level in majority of the cases [14, 15, 16, 17, 18]. Fungicidal control is largely practiced for
79 blast disease in temperate or subtropical rice cultivation, primarily in Japan, China, South
80 Korea, Taiwan and, increasingly, Vietnam [18].

81 For the management of blast, fungicides such as Isoprothiolane, Probenazole,
82 Pyroquilon, Tricyclazole [19] and most of the other fungicides like Benomyl, Carbendazim,
83 Chloroneb, Captafol, Mancozeb, Zineb, Edifenphos, Iprobenphos, Thiophanate, Carboxin,
84 Kitazin, Flutolanil, etc. are found to be effective for blast disease management under field
85 conditions [20, 21, 22, 23, 24]. For sheath blight, most of the fungicides like benomyl,
86 carbendazim, chloroneb, captafol, mancozeb, zineb, edifenphos, iprobenphos, thiophanate,
87 carboxin, etc. have been found effective under field conditions [22, 23, 24].

88 Recently, many combination fungicides such as Trifloxystrobin 25% + Tebuconazole
89 50% 75WG, Azoxystrobin 18.2% + Difenoconazole 11.4% SC, Kasugamycin 5% + Copper
90 Oxychloride 45% WP and Kresoxim methyl 40% + Hexaconazole 8% WG have been shown
91 to control the blast and sheath blight disease under field condition [25, 17, 26]

Fungicides have been used successfully to control blast and sheath blight but, due to continuous development of fungicide tolerance in fungal population, it is inevitable to search for a new group of fungicide with different mode of action so that new information on diverse fungicides with different modes of action can be offered to farmers. In this view, the present study was undertaken to appraise the field efficacy of Trifloxystrobin 25% + Tebuconazole 50% 75WG, a combination fungicide having strobilurin (Trifloxystrobin 25%) and triazole (Tebuconazole 50%) group of fungicide against blast and sheath blight disease of paddy under field conditions.

2. Material and Methods

Layout, Fungicides and Crop establishment: A randomized complete block design (RCBD) field experiment was conducted at the experimental fields of Agricultural Research Station, Gangavathi, Karnataka (5.4319° N, 76.5315° E) during 2014 & 2015 autumn seasons. A popular rice variety BPT5204 which is susceptible to blast and sheath blight disease was used for the study. Seeds were sown in the month of July and planted in August. Before sowing, healthy seeds were water soaked overnight and incubated in the gunny bags for better sprouting in the nursery. The land was prepared by puddling method by applying one ploughing followed by two ploughing after one week. The experiment was laid out in RCBD with a plot size of 5 × 4 m each for all treatments. Seedlings of 30 days old were planted in trail plots at 20×10 cm spacing. All standard agronomic practices were followed except using higher nitrogenous (200 kg ha⁻¹) and lower pottasic (50 kg ha⁻¹) fertilizer dose than the normal dose (N₂:P₂O₅:K₂O:150:75:75).

The RCBD experiment comprises nine treatments with three replications each. A new formulations viz., Trifloxystrobin 25% + Tebuconazole 50% (Nativo 75 WG), Kresoxim methyl (Ergon 44.3 SC), Thifluzmide 24 SC (Spencer), Avatar (Hexaconazole 4% + Zineb 68%), Merger (Tricyclazole 18 % + Mancozeb 62 % WP) and SAAF 75 WP (Carbendazim

12% + Mancozeb 63% WP) were included in the treatment. Commercially available popular fungicides like Tricyclazole 75 WP (Beam) @ 0.6 g/lit and Carbendazim 50 WP @ 1.5 g/lit were used for comparison (Table 1). Bio-efficacy was evaluated by spraying all the test chemicals twice at 15 days interval starting from the initiation of the disease.

Artificial inoculation: Sheath blight disease was artificially inoculated to all experimental treatments after 45 days of planting following the mycelium with typha grass method described previously [27]. Blast disease was evaluated based on natural disease incidence.

Disease assessment and statistical analysis: Fourteen days after the fungicide application disease assessment was carried out. The disease was measured using the disease rating scale of 0-9 developed by International Rice Research Institute (IRRI, 1996) for blast and sheath blight disease. Further, the scored data was converted into per cent disease index (PDI) using formula given below. The data on the yield were recorded by marking 3 x 2 m section within each plot using a wire frame as described by [28] and tillers within the frame were cut and harvested in order to determine the yield. Data from autumn 2014 & 2015 seasons were pooled to get the average PDI and yield values. Subsequently, the data on disease severity and yield parameters were subjected to appropriate statistical analysis. Cost to Benefit cost ratio (B:C) was calculated by considering the cost of cultivation (including the cost of test fungicides) and market price of the product.

$$\text{PDI} = \left[\frac{\text{Sum of the scores}}{\text{Number of Observation} \times \text{Highest Number in Rating Scale}} \right] \times 100$$

3. Result and Discussion

Field experiment revealed that the treatment Trifloxystrobin 25% + Tebuconazole 50% (Nativo 75 WG) @ 0.4 g/l recorded lowest PDI of blast (17.02) and sheath blight (24.70) (Table 1, 2. & Fig.1). There was a significant difference among the treatments with respect to PDI of blast and sheath blight diseases and all treatments recorded significantly lower PDI compared to untreated control in both the seasons. Mean while, other combination fungicide i.e.

Tricyclazole 18% + Mancozeb 62% WP (Merger) recorded blast PDI of 26.03 which is statistically on par with Kresoxim methyl 44.3 SC (Ergon) @ 1.0 ml/l (PDI 28.48) and Tricyclazole 75 WP (Beam) @ 0.6 g/l (PDI 25.91). This report is supported by the previous report [29], where they have reported the effectiveness of Trifloxystrobin 25%+Tebuconazole 50% 75WG in controlling the leaf blast disease of paddy under field condition. Previous workers have also reported the effectiveness strobilurin fungicides in reducing the blast disease compare to other fungicides [30].

Test fungicide Trifloxystrobin 25% + Tebuconazole 50% (Nativo 75 WG) @ 0.4 g/l performed better with PDI of 17.02 than the Tricyclazole 75 WP @ 0.6 g/h (PDI 25.91), a widely used fungicide against blast disease in India. This could be due to repeated use of Tricyclazole 75 WP for blast disease management from many years which may have lead to the development of resistant fungal population. This observation is in agreement with the previous researchers [31], where they have recommended the rotation of different groups of fungicide for managing the development of fungicide resistance population.

Data from sheath blight disease suggested that the other fungicides of the experiment (solo/combination) such as Thifluzamide 24 SC (Spenser) @ 0.75 ml/l (PDI 37.26), Hexaconazole 4% + Zineb 68% (Avatar) @ 2.0 g/l (PDI 34.94) and Carbendazim 12% + Mancozeb 63% WP (SAAF) @ 2.0 g/l (PDI 36.66) are on par among themselves but stands next to the Trifloxystrobin 25% + Tebuconazole 50% (Nativo 75 WG) @ 0.4 g/l (PDI 24.70). This finding is supported by the results of previous investigations [25], where Trifloxystrobin 25% + Tebuconazole 50% (Nativo 75 WG) @ 0.4 g/l performed better in reducing the sheath blight severity. Similarly, Bhuvaneshwari & Raju, in 2012 [17] reported the better efficacy of a combination fungicide azoxystrobin 18.2% + difenoconazole 11.4% SC (strobilurin + triazole) against sheath blight disease. Our report also confirms the better efficacy of strobilurin derived fungicide (either solo or in combination) against sheath blight disease of rice [32]. Various

experimental reports confirmed that strobilurin compounds found to be effective in controlling many rice diseases like grain discoloration [25], blast [33] sheath rot and brown spot [34].

In our study difference in the disease severity among different treatment was reflected in the final grain yield, a significant increase in the grain yield was observed in the plots treated with test chemical Trifloxystrobin 25% + Tebuconazole 50% (Nativo 75 WG) @ 0.4 g/l (55.13 q/h) compare to the other fungicidal treatments which recorded the yield in the range of 40.75-48.12 q/h (Table.3 & Fig.1). The lowest yield was recorded in the unsprayed control plots (36.33 q/h). Our results are in conformity with previous reports [17, 29, 32, 35, 36, 37, 38]. Previous workers reported that fungicides application increases the yield of rice. In the present study, the fungicide Trifloxystrobin 25% + Tebuconazole 50% (Nativo 75 WG) @ 0.4 g/l have found superior in reducing the leaf blast and sheath blight disease PDI and therefore increased the grain yield (55.13 q/h) (Table 3 & Fig.1).

Due to non availability of location specific resistance varieties for blast disease, the chemical control is an important strategy for the farmers to harvest economic yield. Although, resistant variety is a best option to reduce the cost of cultivation but cultivation of such resistant varieties with few protective fungicidal spray will reduce the risk of development of matching virulence by suppressing the population growth of matching virulence. Moreover, poor bio-efficacy of the bio-control agents under the severe epidemic condition makes the chemical control is an inevitable and ultimate means for blast disease management for farmers. For sheath blight, though cultivation of resistant variety is the best option but till date no such variety is available to the farmers. Thus, in present situation cultural practices combined with foliar spray of fungicide is the most common practice to manage the disease and even in integrated pest management system need based application of fungicide has been recommended [32].

4. Conclusion

Present investigation provides the field efficacy of a fungicide premixture Trifloxystrobin 25% + Tebuconazole 50% (Nativo 75 WG) @ 0.4 g/l for management of blast and sheath blight diseases of paddy.

References

1. Bonman JM. Estrada BA. Kim CK. Ra DS. Lee EJ.. Assessment of blast disease and yield loss in susceptible and partially resistant rice cultivars in two irrigated low land environments. *Plant Dis.* 1991;75: 462-466.
2. Jia Y. Me Adams SA. Bryan GT. Hershay HP. B.Valent. Direct interaction of resistance genes products confers rice blast resistance. *Embo.J.*. 2000;19:4004 - 4014.
3. Chaudhary B. Karki BP. Lal KK. Neck blast resistant lines of Radha-17 isolated. *Int. Rice Res. Notes.* 1994;19:11.
4. Teng PS. Klein-Gebbinck H. Pinnschmidt H. An analysis of the blast pathosystem to guide modeling and forecasting. *In: Blast modeling and forecasting*, IRRI, Manila, Philippines, 1991;pp 1-30.
5. Chaudhary B. Effect of blast disease on rice yield. *Nepal Agri. Res. J.* 1999;3: 8-13.
6. Koutroubas SD. Katsantonis D. Ntanos DA. Lupotto E. Blast disease influence on agronomic and quality traits of rice varieties under Mediterranean conditions. *Turkish J. Agri. Forestry.* 2009;33: 487-494.
7. Ou SH. *Rice Diseases*, 2nd edn. Commonwealth Mycological Institute, Surrey. 1985
8. Teng PS. Torries CQ. Nuque FL. Calvero SB. Current Knowledge on crop losses in tropical rice. *In: IRRI (ed) Crop loss assessment in rice*. International Rice Research Institute, Los Banos, 1990;pp 39-54.
9. Savary S. Willocquet L. Elazegui FA. Castilla N. Teng PS. Rice pest constraints in tropical Asia: quantification and yield loss due to rice pests in a range of production situations. *Plant Disease.* 2000;84: 357-369.
10. Savary S. Teng PS. Willocquet L. Nutter FW. Jr. Quantification and modeling of crop losses: a review of purposes. *Annual Review of Phytopathology.* 2006;44: 89-112.
11. Rajan CPD. Estimation of yield losses due to sheath blight of rice. *Indian Phytopathology.* 1987;40: 174-177.

12. Roy AK. Sheath blight of rice in India. Indian Phytopathology. 1993;46: pp 97-205.
13. Savary S. Mew TW. Analyzing crop losses due to *Rhizoctonia solani*: rice sheath blight, a case study. In: Sneh B, Javaji-Hare S, Neate S, Dijst G (eds) *Rhizoctonia* species: taxonomy, molecular biology, ecology, pathology and disease control, Kluwer, Dordrecht, 1996; 237-244.
14. Venkata Rao G. Muralidharan K. Fungicides and control of leaf blast in dry nursery. Indian Phytopathology. 1983;36: 355.
15. Varie M. Maiti D. Shukla VD. Efficacy of combination of fungicide formulations on management of rice-blast (*Pyricularia oryzae*) in rainfed upland. Indian J. Agri. Sci. 1993;63:386-389.
16. Kandhari J. Gupta RL. Efficacy of fungicides and resistance inducing chemicals against sheath blight of rice. J. Mycological Res. 2003;41: 67-69.
17. Bhuvaneswari V. Raju KS. Efficacy of New Combination Fungicide against Rice Sheath Blight Caused by *Rhizoctonia solani* (Kuhn). J. Rice Res. 2012;5 (1 & 2).
18. Kumar PMK. Sidde Gowda DK. Rishikant M. Kiran Kumar N. Pandurange Gowda, KT. Vishwanath K.. Impact of fungicides on rice production in India In: Fungicides-showcases of integrated plant disease management from around the world (open access chapter). 2013; pp. 77-98.
19. Filippi MC. Prabhu AS. Integrated effect of host plant resistance and fungicidal seed treatment on rice blast control in Brazil. Plant Dise. 1997;81:351-355.
20. Varma AS. Menon MR. Fungicidal trial on the control of sheath blight of rice. Madras Agricultural J. 1977;64:416-417.
21. Araki F. Monocot (Flutolanil), a new systemic fungicide. Japan Pesticide Information. 1985;47: 23-25.
22. Dash SC. Panda S. Chemical control of rice sheath blight disease. Indian Phytopathol. 1984;37: 79-82.
23. Kannaiyan S. Prasad NN. Effect of foliar spray of certain fungicides on the control of sheath blight of rice. Madras Agricultural J. 1984;71: 111-114.
24. Singh R. Sinha AP. Comparative efficacy of local bioagents, commercial bioformulation and fungicide for the management of sheath blight of rice under glass house conditions. Indian Phytopathol. 2004; 57: 494-496.
25. Bag MK. Saha S. Fungitoxic effect of Nativio 75 wg (trifloxystrobin 25%+ tebuconazole 50%) on grain discoloration (GD) disease of rice in West Bengal. Pestol. 2009;33: 47-49.

26. Kumar PMK. Veerabhadraswamy AL. Appraise a combination of fungicides against blast and sheath blight diseases of paddy (*Oryza sativa* L.). J.Exper. Biol . Agricultural Sci. 2014;2:49-57
27. Bhaktavatsalam G. Satyanarayana K. Reddy APK. John VT. Evaluation of sheath blight resistance in rice. Int. Rice Res. Newsl. 1978; 3: 9-10.
28. Seebold KW. Datnof JLE. Correa –Victoria FJ. Kucharek TA. Snyder GH. Effects of Silicon and fungicides on the control of leaf and neck blast in Upland rice. Plant Dis.2004; 88:253-258.
29. Usman GM. Waqas W. Sahi ST. Saleemil-Yasin. Influence of various fungicides on the management of rice blast disease. Mycopathol.2009; 7:29-34.
30. Debashis D. Supradip S. Prasad RD. Kumar BM.. Effect of different active fungicides molecules on the management of rice blast disease. International Journal of Agriculture, Environment and Biotechnology. 2012;5: 247-251.
31. Tangdiabang J. Pakki S. Penyakit blast (*Pyricularia grisea*) dan strategi pengendaliannya pada tanaman padi. Pusat Penelitian Tanaman Pangan Departmen Pertanian. 2006;7: 241-245.
32. Bag MK. Yadav M. Mukherjee A.K. Bioefficacy of strobilurin based fungicides against rice sheath blight disease. Transcriptomics. 2016;4:128.
33. Pramesh D. Nataraj K. Guruprasad G.S. Mahantashivayogayya K. Reddy BGM. Evaluation of a new strobilurin group of fungicide for the management of blast disease of paddy. *American J. Experimental Agriculture*. 2016; 13(5): 1-6.
34. Biswas A. Bag MK. Strobilurins in management of sheath blight disease of rice: A review. Pestology. 2010;34: 23-26.
35. Sood GK. Kapoor AS. Efficacy of new fungicides in the management of rice blast. Plant Disease Research. 1997;12:140-142.
36. Tirmali AM. Latake SB. Bendr, NJ. Evaluation of new fungicides for control of blast disease of rice. J.Maharashtra Agricultural University. 2001;26:197-198.
37. Prabhu AS. Filippi MC. Zimmermann FJP. Cultivar response to fungicide application in relation to rice blast control, productivity and sustainability. Pesq. Agropec. Bras. Brasilia. 2003;38: 11-17.
38. Naik GR. Naik GB. Naik BT Naik KR. Fungicidal management of leaf blast disease in rice. Global .Journal .Bio science &.Biotechnology. 2012;1 (1): 18-21.

Table-1: Effect of Trifloxystrobin 25% + Tebuconazole 50% 75WG on blast disease of rice (Pooled from *autumn* – 2014 & 2015)

Sl No	Treatments	Dose/l	Leaf Blast Disease Severity (PDI)				
			2014		2015		Pooled
			Before spray	14d after spray	Before spray	14d after spray	
T 1	Trifloxystrobin 25% WP + Tebuconazole 50% WP (Nativo)	0.4 g	15.55 (23.18)	17.60 (24.80)	13.35 (21.42)	16.44 (23.93)	17.02 (24.35)
T 2	Kresoxim methyl (Ergon 44.3 SC)	1.0 ml	14.38 (22.26)	27.21 (31.45)	14.26 (22.18)	29.75 (33.05)	28.48 (32.25)
T 3	Thifluzamide 24 SC (Spencer)	0.75 ml	19.39 (26.12)	31.10 (33.89)	14.44 (22.32)	35.97 (36.85)	33.53 (35.38)
T 4	Hexaconazole 4% + Zineb 68% (Avatar)	2.0 g	16.66 (24.08)	33.60 (35.43)	15.55 (23.22)	29.28 (32.77)	31.44 (34.10)
T5	Tricyclazole 18% + Mancozeb 62% WP (Merger)	1.5 g	15.11 (22.82)	25.71 (30.46)	13.86 (21.84)	26.35 (30.83)	26.03 (30.67)
T6	Tricyclazole 75 WP (Beam)	0.6 g	14.38 (22.28)	26.10 (30.72)	14.44 (22.32)	25.72 (30.46)	25.91 (30.59)
T7	Carbendazim 50 WP (Bavistin)	1.0 g	20.00 (26.57)	36.10 (36.93)	15.55 (23.18)	30.28 (33.40)	33.19 (35.11)
T8	Carbendazim 12% + Mancozeb 63% WP (SAAF)	2.0 g	14.44 (22.32)	31.12 (33.92)	13.82 (21.82)	34.55 (36.01)	32.83 (34.98)
T9	Unsprayed Control		16.86 (24.24)	46.93 (43.23)	14.56 (22.42)	38.28 (38.45)	42.6 (40.74)
Co-efficient of Variance (CV)			NS	10.54	NS	13.56	NS
Critical Difference (CD)			NS	4.17	NS	5.14	NS

* Figures in the parentheses represent arcsine transformed values

Table-2: Effect of Trifloxystrobin 25% + Tebuconazole 50% 75WG on sheath blight disease of rice (Pooled from *autumn* – 2014 & 2015)

Sl No.	Treatments	Dose/l	Sheath blight (PDI)		
			2014	2015	Pooled
T 1	Trifloxystrobin 25% WP + Tebuconazole 50% WP (Nativo)	0.4 g	23.55 (29.05)	25.86 (30.55)	24.70 (29.80)
T 2	Kresoxim methyl (Ergon 44.3 SC)	1.0 ml	41.38 (40.00)	43.05 (41.00)	42.21 (40.53)
T 3	Thifluzamide 24 SC (Spencer)	0.75 ml	35.82 (36.78)	38.71 (40.87)	37.26 (37.60)
T 4	Hexaconazole 4% + Zineb 68% (Avatar)	2.0 g	33.33 (35.24)	36.55 (37.17)	34.94 (36.25)
T5	Tricyclazole 18% + Mancozeb 62% WP (Merger)	1.5 g	44.99 (42.12)	42.77 (40.82)	43.88 (41.48)
T6	Tricyclazole 75 WP (Beam)	0.6 g	39.99 (39.22)	45.85 (42.62)	42.92 (40.94)
T7	Carbendazim 50 WP (Bavistin)	1.0 g	37.33 (37.64)	38.88 (38.55)	38.10 (38.09)
T8	Carbendazim 12% + Mancozeb 63% WP (SAAF)	2.0 g	35.55 (36.60)	37.77 (37.90)	36.66 (37.25)
T9	Unsprayed control	--	47.77 (43.68)	55.68 (48.25)	51.72 (46.01)
Co-efficient of Variance (CV)			10.8	12.42	13.26
Critical Difference (CD)			4.7	5.13	4.98

* Figures in the parentheses represent arcsine transformed values

Table-3: Effect of Trifloxystrobin 25% +Tebuconazole 50% 75WG on grain yield

SI No.	Treatments	Dose/l	Yield (Q/h)			B:C
			2014	2015	Pooled	
T 1	Trifloxystrobin 25% WP + Tebuconazole 50% WP (Nativo)	0.4 g	56.50	53.75	55.13	2.21
T 2	Kresoxim methyl (Ergon 44.3 SC)	1.0 ml	46.50	47.00	46.75	1.87
T 3	Thifluzamide 24 SC (Spencer)	0.75 ml	50.62	41.50	46.06	1.9
T 4	Hexaconazole 4% + Zineb 68% (Avatar)	2.0 g	50.87	39.12	44.99	1.82
T5	Tricyclazole 18% + Mancozeb 62% WP (Merger)	1.5 g	48.62	47.15	47.88	1.66
T6	Tricyclazole 75 WP (Beam)	0.6 g	50.25	46.00	48.12	2.0
T7	Carbendazim 50 WP (Bavistin)	1.0 g	41.40	40.75	41.07	1.74
T8	Carbendazim 12% + Mancozeb 63% WP (SAAF)	2.0 g	43.00	38.50	40.75	1.7
T9	Unsprayed Control	--	37.36	35.30	36.33	1.6
Co-efficient of Variance (CV)			11.06	14.17	10.55	
Critical Difference (CD)			5.6	4.2	6.05	

Note: B:C – Benefit cost

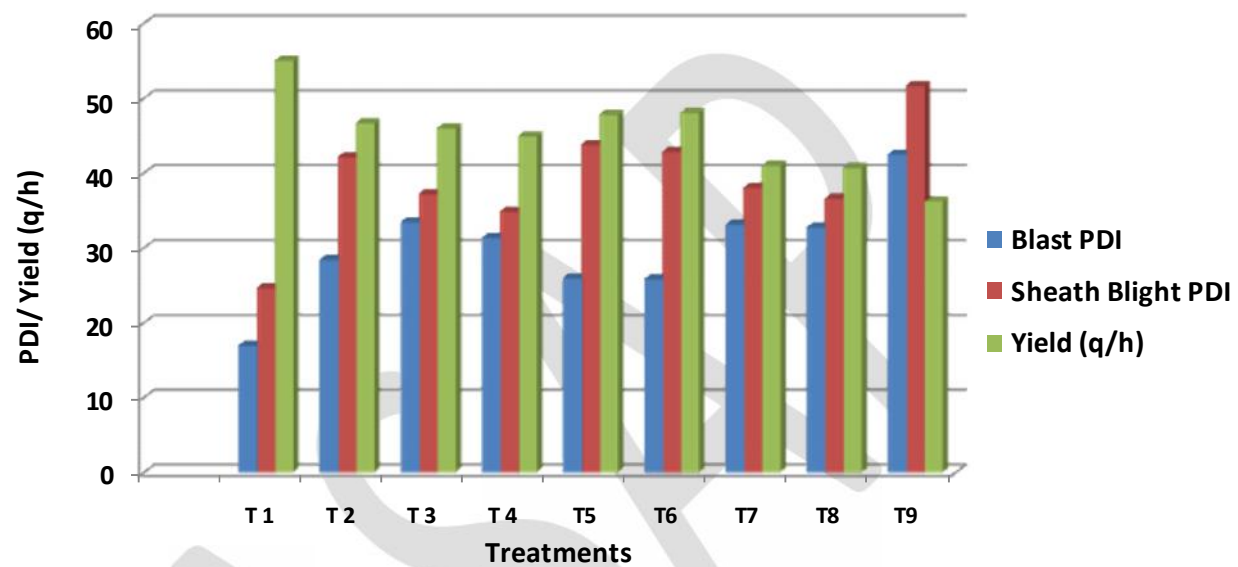


Fig.1. Graphical representation of percent disease index (PDI) and yield (q/h) obtained in different treatments.