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In vivo evaluation of fungicides and essential oils against sheath rot of rice

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Abstract
Among eight fungicides evaluated against sheath rot of rice under field condition, pooled data indicated that Carbendazim 25% + Mancozeb 50% WS @ 1.0 ml/L recorded highest per cent disease control and yield with 57.02% and 4.10kg/plot respectively followed by Zineb 68%+ Hexaconazole 4% WP @ 1.0 gm/L with 54.81% disease control and 4.08kg/plot yield and less effectiveness was observed in Azoxystrobin 11% + Tebuconazole 18.3% w/w SC @ 1.0 ml/L treated plot. In case of essential oils lemon grass oil recorded highest disease control with 31.12% and 3.88kg/plot yield among seven essential oils evaluated, followed by Niragundi oil treated plot and least was observed in Eucalyptus oil treated plot.

Keywords: Sheath rot, fungicides, essential oils

Introduction
Rice (*Oryza sativa* L.) is the second most important cereal crop grown throughout the world. It plays a vital role as a primary source of energy for more than 60% of population in India. The prevalence of diseases and pests has been recognized as a major problem for decreased productivity in rice (Siddiq, 2000) [5]. Rice is susceptible to a number of illnesses *Sarocladium oryzae* (Sawada) has caused rice sheath rot grew in importance as a result of large quantitative and qualitative yield losses ranging from 3 to 85% (Reddy, 1991). Many workers have suggested that various fungicides are useful against rice sheath rot. (Rajan and Nair, 1978; Raina and Singh, 1980; Vidhyasekaran and Lewin, 1987) [2, 1, 7]. To design a strategy for the control of rice sheath rot, detailed trials are investigated to establish the efficiency of various groups of fungicides and essential oils. With this in perspective, the current *in vivo* trials were carried out to evaluate the efficacy of several fungicides and essential IOLs for sheath rot management.

Materials and methods
The experiment was conducted in a randomized block design with three replications using susceptible variety MTU-7029 (Swarna) during *Kharif* 2018 and 2019. All of the necessary agronomic activities have been used to cultivate the crop in a plot size of 5 X 2m. The fungicidal sprays were done at panicle initiation and second spray was done after 10 days. Observations on disease incidence were recorded on randomly selected ten tillers from each treatment. Per cent disease incidence was calculated by using the formulae:

$$\text{Disease incidence} = \frac{\text{Number of diseased tillers/hill}}{\text{Total number of tillers/hill}} \text{ X100}$$

And yield parameters like grain yield per plot were recorded and converted to per ha. The essential oil experiment followed the same methodology as that of the fungicides experiment. The experiment was also conducted in the year 2019. List of fungicides and essential oils used were given in the table 1 and table 2.

Results and Discussions
Evaluation of Fungicides on sheath rots of rice
In both 2018 and 2019, the data reported in Table 3 and Fig. 1 indicated that all treatments effectively reduced the occurrence of sheath rot as compared to the control. According to pooled statistics, Carbendizim 25% + Mancozeb 50% WS @ 1.0 ml/L had the lowest disease

incidence (21.77%) and the highest disease control (57.02%) of all the treatments, followed by Zineb 68%+ Hexaconazole 4% WP @ 1.0 gm/L with 22.82% disease incidence, 54.81% disease control and 4.08kg/plot yield, Azoxistrobin 18.2% + difenoconazole 11.4% w/w SC @ 1.0 ml/L recorded 22.92% disease incidence, 54.61 per cent disease control and 3.96kg/plot yield, Trifloxystrobin 25% + Tebuconazole 50% w/w WG (75% WG) @ 1.0 ml/L with 23.15% disease incidence, 54.25% disease control and 3.95kg/plot yield, Fluxapyroxad 62.5 g/l + Epoxiconazole 62.5 g/l EC @ 1.0ml/L with 23.72% disease incidence, 53.02% disease control and 3.64kg/plot, Tricyclazole 18% + Mancozeb 62% WP 2gm/L with 25.07%disease incidence, 50.35% disease control and 3.61kg/plot yield, Flusilazole 12.5% + carbendazim 25% @ 1.0 ml/L with 25.40% disease incidence, 49.70% disease control and 3.68kg/plot yield and compared to other treatments least disease per cent disease control and low yield recorded in the plot treated with Azoxystrobin 11% + Tebuconazole 18.3% w/w SC @ 1.0 ml/L with 26.27%disaese incidence, 48.11% disease control and 3.21kg/plot yield. Earlier, Rajan and Nair (1978) [2] reported that carbendazim and benomyl have controlled the sheath rot of rice effectively. Similarly, the effectiveness of carbendazim was emphasised by Raina and Singh (1980) [1] and Vidhyasekaran and Lewin (1987) [7], whereas the effectiveness of mancozeb (0.2%) was reported by Thrimurty (1986) [6] for the control of sheath rot of rice.

Evaluation of essential oils on sheath rots of rice

Table 4 and Fig. 2 show that, when compared to the control, all treatments effectively reduced the occurrence of sheath rot in both 2018 and 2019. According to statistics compiled, lemon grass oil control the disease by 31.12% and highest yield with 3.88kg/plot which is highest among the essential oil, Nirgundi oil with 28.92% disease control and 3.35kg/plot yield and clove oil controlled the disease by 28.81% with 3.32kg/plot yield both are on par with each other followed by cedar wood oil with 26.49% disease control and 3.13kg/plot yield, Neem oil with 26.35% disease control and 2.99kg/plot yield, Citronella oil with 25% disease control and 2.87 kg/plot and in comparison to other essential oils, Eucalyptus oil proved less effective, with 24.39% disease control and 2.72 kg/plot yield. Present investigation is contradictory of Ramasamy *et al*. (2017) [3] reported that Lemon grass oil have significant effect on controlling Sheath rot disease of Rice.

Table 1: List of fungicides

Sl. No.	Trade name	Name of the chemical	Dose (g or ml)
1	Lusture	Flusilazole 12.5% + carbendazim 25% SC	1.0
2	Amistrar top	Azoxistrobin 18.2% + difenoconazole 11.4% w/w SC	1.0
3	Custodia	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	1.0
4	Merger	Tricyclazole 18% + Mancozeb 62% WP	2.0
5	Avatar	Zineb 68%+ Hexaconazole 4% WP	1.0
6	Nativo	Trifloxystrobin 25% + Tebuconazole 50% w/w WG	1.0
7	Sprint	Carbendazim 25% + Mancozeb 50% WS	1.0
8	Adexar	Fluxapyroxad 62.5 g/l + Epoxiconazole 62.5 g/l EC	1.0

Table 2: list of Essential oils

Sl. No.	Name of the essential oil	Botanical name	Dose
1	Citronella oil	*Ciybopogan nardus*	1.0 ml/L
2	Eucalyptus oil	*Eucalyptus globulus*	1.0 ml/L
3	Cedar wood oil	*Cedrus deodara*	1.0 ml/L
4	Nirgundi oil	*Vitex negundo*	1.5 ml/L
5	Lemon grass oil	*Cymbopogon flexuosus*	1.25 ml/L
6	Clove oil	*Syzygium aromaicum*	1.25 ml/L
7	Neem oil	*Azadirachta indica*	1.0 ml/L

Table 3: Effect of Fungicides on incidence of sheath rot of rice and yield

SL. NO	Treatments	Severity of disease (%)			Per cent disease control			yield					
								Kg/plot			Kg/ha		
		2018	2019	pooled	2018	2019	pooled	2018	2019	pooled	2018	2019	pooled
1	Flusilazole 12.5% + Carbendazim 25% EC	25.40	25.40	25.40	49.89	49.80	49.70	3.61	3.765	3.6875	3610	3765	3687.5
2	Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC	22.20	22.90	22.92	55.95	54.74	54.61	4.155	3.765	3.96	4155	3765	3960.0
3	Azoxystrobin 11% + Tebuconazole 18.3% w/w SC	27.55	25.00	26.27	45.43	50.59	48.11	2.98	3.45	3.21	2985	3450	3217.5
4	Tricyclazole 18% +Mancozeb 62% WP	23.40	23.45	23.15	53.57	53.75	54.25	3.82	4.17	3.99	3825	4170	3997.5
5	Zineb 68% + Hexaconazole 4% WP	21.45	22.85	22.82	57.44	54.84	54.81	4.18	3.84	4.08	4180	3840	4080.0
6	Trifoxystobin 25% + Tebuconazole 50% WG	24.00	26.15	25.07	52.33	48.41	50.35	3.81	3.615	3.71	3810	3615	3712.5
7	Mancozeb 50% + Carbendazim 25% WS	21.20	22.35	21.77	57.93	55.92	57.02	4.32	4.10	4.14	4320	4100	4140.0
8	Fluxapyroxad 62.5 g/l + Epoxiconazole 62.5 g/l EC	25.30	24.40	23.72	49.80.	51.77	53.02	3.54	3.74	3.64	3540	3740	3645.0
9	control	50.40	50.60	50.50	0	0	0	2.17	2.26	2.215	2170	2260	2215.5
	CD (P=0.05)	5.77	5.23	3.34	3.95	6.64	5.40	0.41	0.18	0.47	410.72	186.26	535.79
	S.Em (±)	1.74	1.57	1.01	1.19	2.00	1.63	0.12	0.05	0.14	124.02	56.24	161.78
	CV%	9.21	8.24	5.32	3.67	6.13	5.00	4.88	2.18	5.45	4.82	2.16	6.29

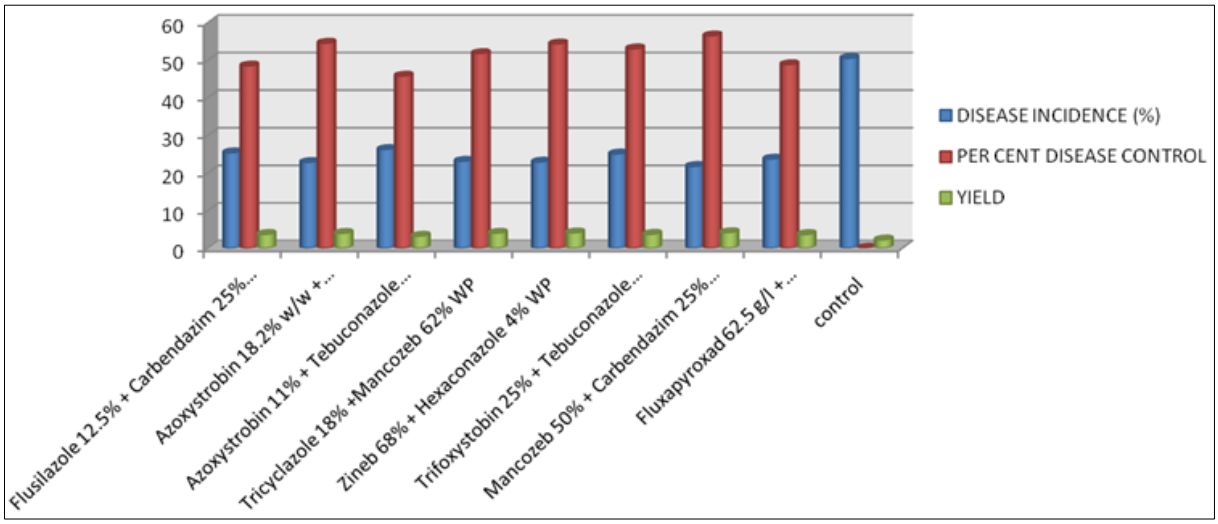

Fig 1: Effect of Fungicides on incidence of sheath rot of rice and yield

Table 4: Effect of Essential oils on incidence of sheath rot of rice and yield

Sl. No	Treatments	Severity of disease (%)			Per cent disease control			yield					
								Kg/plot			Kg/ha		
		2018	2019	pooled	2018	2019	pooled	2018	2019	pooled	2018	2019	pooled
1	Citronella oil	57.20	53.65	55.42	20.88	29.00	25.00	2.545	3.20	2.872	2,545	3,200	2872.5
2	Eucalyptus oil	55.70	56.05	55.87	22.95	25.76	24.39	2.53	2.84	2.72	2,530	2,840	2720.0
3	Cedar wood oil	55.70	52.95	54.32	22.95	29.86	26.49	2.90	3.45	3.13	2,900	3,455	3130.0
4	Niragundi oil	52.85	52.45	52.65	27.45	30.30	28.92	3.45	3.56	3.35	3,450	3,560	3350.0
5	Leongrass oil	50.45	51.45	50.95	30.29	31.85	31.12	3.53	3.88	3.70	3,530	3,880	3705.0
6	Clove oil	52.05	53.20	52.62	28.00	29.53	28.81	3.21	3.47	3.32	3,210	3,470	3327.5
7	Neem oil	55.75	53.10	54.42	22.89	29.66	26.35	2.67	3.32	2.99	2,675	3,325	2990.0
8	Control	72.30	75.55	73.92	0	0	21.70	2.215	2.26	2.23	2,215	2,260	2237.5
	CD (P=0.05)	3.23	3.47	3.48	7.68	5.28	4.66	0.19	0.28	0.42	166.09	288.88	360.53
	S.Em (±)	0.97	1.05	1.07	2.32	1.59	1.43	0.05	0.08	0.13	50.15	87.23	111.12
	CV%	2.47	2.66	2.63	12.71	9.14	9.84	2.79	3.78	6.30	2.42	3.78	5.34

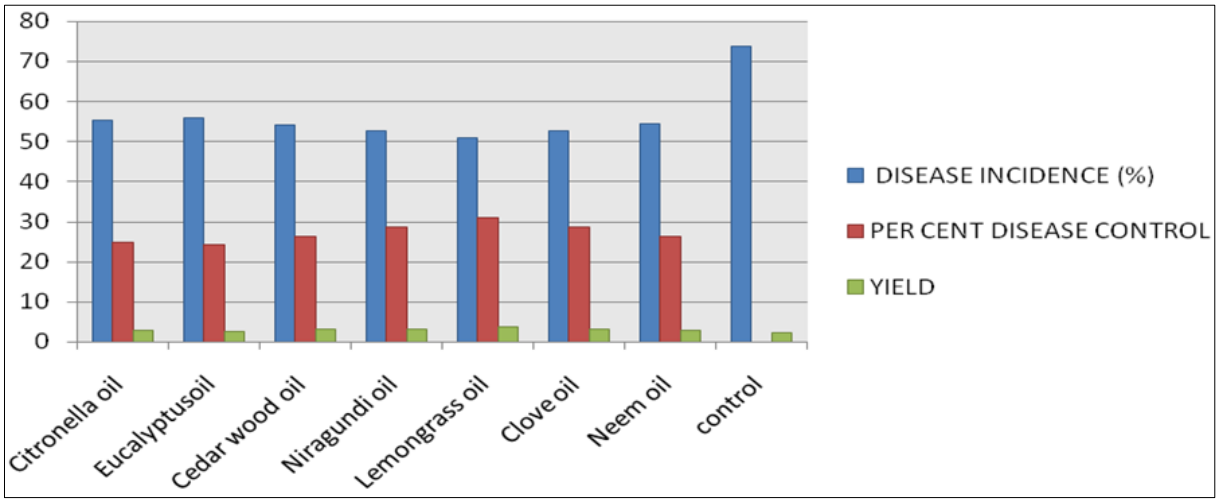

Fig 2: Effect of Essential oils on incidence of sheath rot of rice and yield

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