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Status and incidence of False Smut Disease in rice and their chemical management

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Abstract
Rice (*Oryzae sativa*) is the most staple food crop in world. False smut of rice (*Ustilaginoidea virens*) is one of the major emerging and destructive disease especially in high yielding rice varieties. The incidence of flowering of infected tillers was found ranging from 5 % to more than 50 % in different varieties like Sarjoo 52, NDR 359, HUR- 12. The experimental result revealed that the chemicals Amistar Top (azoxystrobin 18.2 %+ difenoconazole 11.4 % w/w SC) Folicur was found most effective where percentage of infective spikelet's per m^2 reduced to 10.75%. In the term of percentage of infected spikelets/panicle, the treatment with Amistar Top (azoxystrobin 18.2 %+ difenoconazole 11.4 % w/w SC) recorded the lowest percentage i.e. 6.35 % which was at par with the treatment Folicur (tebuconazole 250 EC). The grain yield obtained from each plot it was found that the treatment with Amistar Top (azoxystrobin 18.2 %+ difenoconazole 11.4 % w/w SC) gave the highest grain yield/plot (49.64 q/ha) which was at par with the Folicur (tebuconazole 250 EC) i.e. 48.92 q/ha

Keywords: Status, incidence, false smut disease, rice, chemical management

Introduction
Rice (*Oryzae sativa*) belongs to the grass family *Oryzeae*, and is one of the leading food crops in the world and the most important staple food in Asia. India is one of the largest rice growing country and rice grown in almost all the states of India contributing about 42 per cent to the country's food grain production and provides livelihood to about 70 per cent of the population. The rice crop is subjected to more than forty diseases, which are one of the important factors, for low yields of rice in the world including India. False smut of rice (*Ustilaginoidea virens*) is one of the major emerging and destructive disease especially in high yielding rice varieties. The infection is observed on floral parts and in severe cases the number of infected grains reached even more than 50 % per panicle. The fungus affects young ovary of individual spikelet's and transforms grains into the false smut balls (FSBs) which turned yellow to olive green then blackish also known as pseudomorph. *U. virens* overwinters by producing fungal structures called sclerotia, which contain chlamydospores (resting spores) and compact masses of mycelia. The disease cause both quantitative and qualitative losses. The losses in grain yield occur due to chaffiness and sterility of the spikelet's in the vicinity of grains transformed to smut balls. The chlamydospores also contaminate the rice grains and straws with the toxin (known as ustiloxin and ustilaginoidins), which are poisonous to both humans and animals. During regular survey from three consecutive years in some of the selected farmer's fields of Varanasi growing high yielding varieties, it was noticed that the status and incidence of false smut disease of rice is increasing day by day. The disease incidence of false smut can be noticed only after emergence of floral parts hence spray of novel chemical as a preventive measure is best possible method for the management of false smut disease of rice.

Material and Methods
A random survey was conducted in the Varanasi district and randomely farmers field was selected to observe the disease incidence of false smut. In each selected fields three to five 1 m^2 areas were marked of different rice varieties and observations on number of infected tillers/ m^2 and number of smut balls per infected panicle were recorded. For the management of false smut some novel chemicals were used. A field experiment was conducted at agriculture research farm of Banaras Hindu University, Varanasi during the kharif season 2016-17 and 2017-18 to find out the effective fungicide for the control of false smut disease of rice. Experiment was laid out in Randomised Block Design (RBD) with 10 treatments and three replications. Rice Variety used for the experiment was HUBR 10-9 and the plot size was 5x2 sq. metres fertilizer and irrigation was done as all the normal packages and practices were followed for rice cultivation. Ten fungicides belonging to different groups *viz*

Amistar (azoxystrobin 25 SC), Score (difenconazole 25 EC), Amistar Top (azoxystrobin 18.2 %+ difenoconazole 11.4 % w/w SC), Cabrio-Top 60% WG (Metiram 55% + Pyraclostrobin 5% WG), Monceren (pencycuron 22.9 %), Folicur (tebuconazole 250 EC), Pulsor (thiafluzamide 24 % SC), Lusture 37.5 SE (flusilazole 25%+ carbendazim 12.5%) and Tilt (propiconazole 25 EC), were screened against the false smut of rice. Two sprays were given for each treatment first at booting stage [80 days after transplanting (DAT)] and second at post flowering (100 DAT). Observations on percent of infected panicles/m^2, percent of infected spikelets/panicle were recorded and the yield data was recorded at the time of harvest.

Results and Discussion

The disease incidence of false smut found varying from is placed to another place it was also found varying on the time of flowering and varieties maturing early or late. The incidence of flowering of infected tillers was found ranging from 5 % to more than 50 % in different varieties. The percentage of tillers infected ranged from 10 to 90% in rice varieties like Sarjoo 52, NDR 359, and HUR- 12. There was found significant difference among the chemicals chosen to check the false smut disease severity and their yield. The Data presented in Table 1 was pooled date of the year of 2016-17 and 2017-18. The experimental result revealed that the chemicals Amistar Top (azoxystrobin 18.2 %+ difenoconazole 11.4 % w/w SC) Folicur (tebuconazole 250 EC) and Score (difenconazole 25 EC) was found effective where percentage of infective spikelet's per m^2 reduced to 10.75%, 12.88 % and 16.75 % respectively as compare to control where infected spikelets percentage was 34.68 % per m^2.

Table 1: Effect of Chemicals on false smut disease of rice during Kharif -2016-17 and 2017-18

S. No	Treatment	% of infected panicles/m2	% ofinfected spikelets/panicle	Yield Q/ha
T_1	Amistar (azoxystrobin 25 SC)	19.12 (25.88)	14.59 (22.39)	43.91
T_2	Score (difenconazole 25 EC)	16.75 (24.08)	7.8 (15.94)	46.58
T_3	Amistar Top (azoxystrobin 18.2 %+ difenoconazole 11.4 % w/w SC)	10.75 (19.04)	6.35 (14.34)	53.80
T_4	Cabrio-Top 60% WG (Metiram 55% + Pyraclostrobin 5% WG)	22.43 (28.26)	13.09 (20.96)	42.81
T_5	Monceren (pencycuron 22.9 %)	22.11 (28.02)	13.44 (21.43)	45.36
T_6	Folicur (tebuconazole 250 EC)	12.88 (20.82)	6.49 (14.65)	51.35
T_7	Pulsor (thiafluzamide 24 % SC)	17.80 (24.84)	11.27 (19.50)	44.07
T_8	Lusture 37.5 SE (flusilazole 25%+ carbendazim 12.5%)	25.2 (29.95)	14.70 (22.42)	43.09
T_9	Tilt (propiconazole 25 EC)	22.29 (27.81)	14.93 (22.68)	43.45
T_{10}	Control	34.68 (35.97)	20.08 (26.47)	39.21
S. Em ±		2.13	1.91	2.64
CD at 5%		6.40	5.729	7.92
CV (%)		13.99	16.50	10.11

In the term of percentage of infected spikelets/panicle, the treatment with Amistar Top (azoxystrobin 18.2 %+ difenoconazole 11.4 % w/w SC) recorded the lowest percentage i.e. 6.35 % which was on par with the treatment Folicur (tebuconazole 250 EC) i.e. 6.49 followed by Score (difenconazole 25 EC) i.e. 7.8% recorded the lowest incidence of the disease in terms of percentage of infected spikelets/panicle. The highest percentage of infected spikelets/panicle was observed in untreated control i.e. 20.08 %. Similar results were reported previously for bioefficacy of fungicides under field condition such as carbendazim and propiconazole (Dodan and Singh, 1997) [6], carbendazim (Hegde *et al*., 2000), propiconazole, carbendazim and tebuconazole (Bagga and Kaur, 2006) [3], propiconazole, carbendazim, tebuconazole and carbendazim + mancozeb (Paramjit *et al*., 2006) [10], trifloxystrobin + tebuconazole, propiconazole (Chen *et al*., 2013; Ladhalakshmi *et al*., 2014; Shivamurthy, 2017) [5, 8, 12] They conducted that combination fungicides were better compare to the use of solo or specific fungicides due to their broad range of action.

While maximum of the disease was noticed in the varieties Moti followed by Sonam, BPT 5204 and MTU 7029. In some of the field surveyed all the panicles were found infected with smut balls. Due to this heavy incidence of the disease smut spores are discharge in the air spreading the disease rapidly to the healthy crop fields.

In rice, efficacy of such combination of fungicide are managing many fungal diseases which has been reported (Bag and Saha, 2009; Bhuvaneshwari and Raju, 2012) [1]. In the present study, different combination of fungicide such as Amistar Top (azoxystrobin 18.2 %+ difenoconazole 11.4 % w/w SC) Folicur (tebuconazole 250 EC) and Score (difenconazole 25 EC) showed their superior bioefficacy in controlling the false smut disease incidence and they can be utilized under field condition.

The comparison with the grain yield obtained from each plot it was found that the treatment with Amistar Top (azoxystrobin 18.2 %+ difenoconazole 11.4 % w/w SC) gave the highest grain yield per plot (49.64 q/ha) which was at par with the Folicur (tebuconazole 250 EC) i.e. 48.92 q/ha) followed by the treatment Score (difenconazole 25 EC) i.e. 47.44 q/ha). Grain yield per plot was found to be minimum in untreated control (42.93 q/ha) (Table 1).

In case of rice, many researchers have reported the increased grain yield after application of fungicides due to reduction in biotic stress on plant during their critical growth stages (Sood and Kapoor, 1997; Usman *et al*., 2009; Naik *et al*.,2012; Bag *et al*.,2016) [13, 14, 9, 3].

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