The Pharma Innovation Journal 2022; 11(2): 2608-2613

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(2): 2608-2613

www.thepharmajournal.com
Received: 23-12-2021
Accepted: 31-01-2022

Nitin Kumar Toorray
Assistant Professor, College of Agriculture and Research Station, Marra Patan, Durg, Chhattisgarh, India

Corresponding Author:
Nitin Kumar Toorray
Assistant Professor, College of Agriculture and Research Station, Marra Patan, Durg, Chhattisgarh, India

Evaluation of sheath blight disease management practices combined with different doses of 'N' fertilizer

Nitin Kumar Toorray

Abstract
Rice sheath blight disease is causing significant loss, particularly in areas where high yielding varieties are cultivated. It has a wide range of hosts including cultivated crops, weed plants and various family of horticultural crops. The present study was undertaken during kharif 2016 and kharif 2017 to evaluate the disease management practices combined with different doses of 'N' fertilizer under the field condition. Treatments were allocated under randomized block design (RBD). Disease severity and percent disease index were recorded. The evaluation of sheath blight disease management practice combined with N fertilizer revealed that the susceptible variety + 1/2 RDN + three spray of hexaconazole reduced the sheath blight PDI (32.88%) as compared to control (75.93%).

Keywords: Sheath blight, management practices, different doses of Nitrogen fertilizer, hexaconazole fungicide

Introduction
Rice (*Oryzae sativa* L.) is the staple food crop of over half of the world's population, and is also widely cultivated across the world, making it possibly the most valuable plant on earth (Shimamoto, 1995; Goff, 1999) [16, 6]. It provides 20 percent of the world's supply of dietary energy followed by maize and wheat. Rice grows in at least 114 countries and more than 50 have a capacity of 100,000 tons or more per year. The production of rice to be adept by 2020 is 128 Mt. to feed the growing population in India. This crop also suffers due to number of diseases accounting for severe losses. Of the several factors known to destabilize rice yields, pests and diseases account for 30-40 percent crop losses. Most parts of the country regularly encounter complete crop failure due to epidemics of pests and diseases. In Chhattisgarh, rice production is comparatively smaller than the national average production. A lot of fungal, bacterial, nematode, and viral diseases are attacked on rice. Serious incidences of diseases such as blast, sheath blight and bacterial blight have been reported from rice growing areas in Chhattisgarh regions.

Sheath blight is one of India's widespread and harmful rice disease. Rice sheath blight disease is causing significant loss, particularly in areas where high yielding varieties are cultivated. *Rhizoctonia solani* (Perfect stage-*Thanatephorus cucumeris*) which causes rice sheath blight in both soil and water borne.

Miyake (1910) [11] stated that the sheath blight disease was first reported from Japan, and stated that the casual organism was Sclerotia irregular. Subsequently this disease was recorded from various global rice-growing regions, and particularly from major rice-growing countries. The presence of sheath blight disease in rice from several parts of India and beyond has been confirmed by workers of different parts of India. Butler made reference to the Indian disease as early as 1918. The presence of this disease has been confirmed by Andhra Pradesh, Assam, Jammu and Kashmir, Kerala, Tamil Nadu (Anonymous, 1971) [3], Orissa and West Bengal (Das, 1970) [4], Madhya Pradesh (Anonymous, 1975; Verma *et al.*, 1979) [1, 18].

Older plants are very susceptible to disease. Five to six week old sheaths to the leaf are highly sensitive. Ogoshi (1975) [13] deliberately characterized the genus *Rhizoctonia* as: Branching near the distal end of cells in young, vegetative hyphae at right angle, Formation of a septum in near the point of origin in the branches, Constriction of the branch at its origin, Dolipore septum (present), No clamp connection, no conidium except the moniloid cells, no rind and medulla differentiated sclerotia. The primary inoculum of rice sheath blight was mostly of sclerotia float on the water surface after puddling. In addition to basidiospores, sclerotia of *T. cucumeris* and mycelium in plant debris were also designated as a source of infection.

It has a wide range of hosts including cultivated crops, weed plants and various family of horticulture crops. Both seedlings and adult plants are equally affected but when the disease occurs in seedlings, mortality is much greater. The initial symptoms usually develop as lesions on sheaths of lower leaves close to the waterline, when plants are in the growth stage of late tillering or nearly internode elongation typically these lesions develop as oval to elliptical, green gray, just below the leaf collar, water soaked spots about 1⁄4 inch wide and 1⁄2 to 1⁄4 inch in length. The disease has been named as "sheath blight" because of primary infection on leaf sheath. High doses of nitrogen fertilizers, intensive cultivation of modern high yielding variety, early maturation, high tillering rice varieties with double farming leads to increased severity of diseases, eventually yield losses of about 50% were recorded in Japan, Vietnam, South Korea, Taiwan, China, USA and India (Anonymous, 1988) [2]. Several workers reported, yield loss ranging from 20-50% in highly susceptible cultivars (Lee and Rush, 1983; Rajan and Naidu, 1986; Mizuta, 1956; and Hori, 1969) [10, 15, 12, 7]. Ou (1972) [14] also reported a grain yield loss of 25 per cent due to sheath blight. The disease is common in areas where there is high temperature (30±32 ºC) and relative humidity (> 95 percent) and in intensive cultivation areas.

The pathogen can exist in the soil as a mycelium or a sclerotia. The fungus generates generally long septate mycelium cells that are hyaline when young, yellowish brown when old. It releases a large number of sclerotia, they are irregular, globose or hemispheric, flattended at the base, white when young, and turn brown or dark brown when older. Sclerotia is made up of small mycelial masses. Specific scleroria have a diameter of 1–6 mm. Large sclerotia is considerably more virulent than smaller ones. Sclerotia spread by irrigation water.

Review of Literature

Dev and Mary (1982) [5] reported that the intensive use of nitrogen fertilizer increases the number of farmers / plants and this leads to an increase in the relative humidity of the plant's microclimate, which promotes sheath blight disease. The high indica strains are classified as very susceptible even under high nitrogen levels.

Slaton *et al.* (2003) [17] reported that excessive nitrogen fertilizer use was observed to increase rice damage from sheath blight.

Kueh *et al.* (1985) [9] reported that different levels of nitrogen fertilization did not affect infection. While the increase in nitrogen content increases the incidence of the disease proportionally, the increase in nitrogen content to 120 ppm no longer increases the incidence.

Jagat Janni (2011) [8] investigated that the assessment of disease management practices in combination with different doses of nitrogen fertilizer and observed the significant decrease in severity of sheath blight and the increase in yield in resistant varieties, as well as the 100% recommended dose of nitrogen fertilizer with different doses of hexaconazole effective Practice.

Material and Method

This experiment was conducted in Randomized Block Design during 2016 and 2017 under field condition with three replications of kharif. Twenty-one days test (Swarna) variety seedlings were transplanted into plots of 2x2 m^2 with a plot spacing of 1 m to plot and replication to replication. The spacing between plant to plant was 15 cm and row to row was 15 cm. Recommended dose of fertilizer was applied @ $N_{120}P_{50}K_0$/ha. Total P was given as first basal dose. There was 9 treatments including control with 3 replications were mentioned below:

T1:- Susceptible variety + 2/3rd of Recommended dose of 'N' Fertilizer.

T2:- Susceptible variety + 100% Recommended dose of 'N' Fertilizer + A single spray of an effective fungicide like Hexaconazole (Contaf).

T3:- Susceptible variety + 2/3rd of Recommended Dose of 'N' Fertilizer + A single spray of an effective fungicide.

T4:- Susceptible variety + 100% Recommended Dose of 'N' Fertilizer + Need based number of sprays of an effective Fungicide.

T5:- Susceptible variety + 2/3rd of Recommended dose of 'N' Fertilizer + Need based number of sprays of an effective Fungicide.

T6:- Susceptible variety + ½ of Recommended Dose of 'N' Fertilizer + A single spray of an effective Fungicide.

T7:- Susceptible variety + ½ of Recommended Dose of 'N' Fertilizer + Need based number of sprays of an effective Fungicide.

T8:- Resistant variety + 100% Recommended Dose of 'N' Fertilizer (Control).

At maximum tillering stage, plants of each plot were inoculated with *R. solani* inoculum profusely grown on rice stem bits for inoculation two hills were selected in each lines in each plot. In each treatments the recommended dose of N fertilizer were given in three split doses. First split dose of 'N' fertilizer was applied at the first appearance of the disease symptoms. Second split of N fertilizer were applied on 10th day after the first split and third split was also applied on 10th day after the second split of N fertilizer. To test the efficacy of disease management practices combined with different doses of N fertilizer a single spray of Hexaconazole 5 Sc (Contaf) was done in T3, T4 and T7 treatment at 15 DAI and total no. of three sprays of Hexaconazole 5 Sc (Contaf) were done in T5, T6 and T8 treated at 15, 30 and 40 DAI.

Observations for the disease development difference were taken at every 10th day interval of each spray. At random, tillers in each plot were assessed for disease severity be measuring the total lesion length and total sheath length. Grain yield were also recorded and expressed in Kg/plot at 14% moisture. Disease severity (%) was calculated as.

$$\text{Disease severity (\%)} = \frac{\text{Total lesion length}}{\text{Total sheath length}} \times 100$$

Percent increase or decrease in disease severity over control was calculated as per the formula described by Vincent (1947):

I or D = C - T/ C x 100

Where,

I or D = % increase or decrease over control

C = % disease severity in control

T = % disease severity in treatment

Result and Discussion

The present study was undertaken during kharif 2016 and kharif 2017 to evaluate the disease management practices combined with different doses of 'N' fertilizer under the field condition. Treatments were allocated under randomized block design (RBD). Disease severity and percent disease index were recorded.

In the kharif 2016, the data presented in the table no. 1 indicated that all treatments of disease management practices combined with different doses of Nitrogen fertilizer significantly superior to reduce the sheath blight severity over control treatment on 15th day of inoculation. The data revealed that minimum percent disease index (11.12%) was recorded in T4 (SV + 100% RDN + three spray of Hexaconazole 5 Sc) treatment which is exactly similar to the T5 (SV + 2/3rd RDN + three spray of Hexaconazole 5 Sc) treatment (11.12% PDI), T6 (SV + 1/2 RDN + single spray of Hexaconazole 5 Sc) treatment (11.12% PDI) and T7 (SV + 1/2 RDN + three spray of Hexaconazole 5 Sc) treatments (11.12% PDI) which statistically at par with T3 (SV + 2/3rd RDN + single spray of Hexaconazole 5 Sc) treatment with 11.57% PDI over the control, above treatments are followed by T2 (SV + 100% RDN + single spray of Hexaconazole 5 Sc) treatment with 16.21% PDI, and T1 (SV + 2/3rd RDN) with 30.56% PDI. Maximum PDI (35.19%) was found in the control treatment (SV + 100% RDN).

Results (table no. 1) showed that on 30th day of inoculation revealed that minimum percent disease index of 11.12% was recorded in SV + 1/2 RDN + three spray of Hexaconazole 5 Sc (T7) and was found significantly superior among all the treatments to reduce the disease severity followed by SV + 100% RDN + three spray of Hexaconazole 5 Sc (T4) treatment with 31.71% PDI, SV + 2/3rd RDN + three spray of Hexaconazole 5 Sc (T5) treatment with 33.34% PDI, SV + 1/2 RDN + single spray of Hexaconazole 5 Sc (T6) treatment with 33.34% PDI, SV + 2/3rd RDN + single spray of Hexaconazole 5 Sc (T3) treatment with 39.82% PDI, SV + 100% RDN + single spray of Hexaconazole 5 Sc (T2) treatment with 46.76% PDI and SV + 2/3rd RDN (T1) treatment with 55.56% PDI. Maximum percent disease index (56.25%) was recorded in control treatment SV + 100% RDN (T8).

During the final observation *i.e.* at 40 DAI (table no. 1) of sheath blight disease showed all the treatments were significantly superior to reduce the disease over the control. Data revealed that minimum PDI of 33.34% was recorded in SV + 1/2 RDN + three spray of Hexaconazole 5 Sc (T7) treatment and was significantly reduced the sheath blight disease severity followed by SV + 2/3rd RDN + three spray of Hexaconazole 5 Sc (T5) treatment with 34.72% PDI, SV + 100% RDN + three spray of Hexaconazole 5 Sc (T4) treatment with 35.64% PDI, SV + 1/2 RDN + single spray of Hexaconazole 5 Sc (T6) treatment with 36.57% PDI, T3 (SV + 2/3rd RDN + single spray of Hexaconazole 5 Sc) treatment with 54.17% PDI, T2 (SV + 100% RDN + single spray of Hexaconazole 5 Sc) treatment with 54.63% PDI and T1 (SV + 2/3rd RDN) with 57.41% PDI. The maximum PDI (77.31%) was recorded in control treatment SV + 100% RDN (T8).

The treatment of SV + 1/2 RDN + three spray of Hexaconazole 5 Sc (T7) also increased the yield (4480.24 kg/ha.) which was significantly superior over all treatments and on par with SV + 2/3rd RDN + three spray of Hexaconazole 5 Sc (T5) treatment (4416.47 kg/ha.) followed by SV + 100% RDN + three spray of Hexaconazole 5 Sc (T4) treatment (4320.0 kg/ha.), SV + 1/2 RDN + single spray of Hexaconazole 5 Sc (T6) treatment (4224.0 kg/ha.), SV + 2/3rd RDN + single spray of Hexaconazole 5 Sc (T3) treatment (4160.0 kg/ha.), SV + 100% RDN + single spray of Hexaconazole 5 Sc (T2) treatment (4000.37 kg/ha.) and SV + 2/3rd RDN (T1) treatment (3680.0 kg/ha.) over the control (T8) treatment (3552.44 kg/ha.).

Table 1: The efficacy of disease management practices combined with different doses of 'N' fertilizer (Year-2016)

Treatment No.	Treatments	Percent Disease Index (PDI) 15 DAI	Percent Disease Index (PDI) 30 DAI	Percent Disease Index (PDI) 40 DAI	Yield (Kg/ha)
T1	SV + 2/3rd RDN	30.56 (33.51)	55.56 (48.19)	57.41 (49.26)	3680.0
T2	SV + 100% RDN + single spray of Hexaconazole 5 Sc	16.21 (23.54)	46.76 (43.12)	54.63 (47.65)	4000.37
T3	SV + 2/3rd RDN + single spray of Hexaconazole 5 Sc	11.57 (19.88)	39.82 (39.04)	54.17 (47.39)	4160.0
T4	SV + 100% RDN + three spray of Hexaconazole 5 Sc	11.12 (19.48)	31.71 (34.27)	35.64 (36.66)	4320.0
T5	SV + 2/3rd RDN + three spray of Hexaconazole 5 Sc	11.12 (19.48)	33.34 (35.27)	34.72 (36.10)	4416.47
T6	SV + 1/2 RDN + single spray of Hexaconazole 5 Sc	11.12 (19.48)	33.34 (35.27)	36.57 (36.93)	4224.0
T7	SV + 1/2 RDN + three spray of Hexaconazole 5 Sc	11.12 (19.48)	11.12 (19.48)	33.34 (35.27)	4480.24
T8	SV + 100% RDN (Control)	35.19 (36.38)	56.25 (48.59)	77.31 (61.54)	3552.44
SV	Swarna				
Spray	3				
	SE(m)+-	1.1685	1.5242	0.395	26.115
	CD (5%)	3.5444	4.6231	1.1991	79.1988
	CV	8.4667	6.9644	1.5614	1.1019
	S.Ed	1.6525	2.1555	0.5590	36.926

*Figures in Parenthesis are sine transformed value

During the kharif 2017, the data presented in the table no. 2 revealed that on 15th day of inoculation, minimum percent disease index of 11.12% was recorded in SV + 1/2 RDN + three spray of Hexaconazole 5 Sc (T7) treatment which showed significantly superior in reducing the sheath blight disease severity and was statistically on par with SV + 2/3rd RDN + three spray of Hexaconazole 5 Sc (T5) treatment with 11.58% PDI, SV + 100% RDN + three spray of Hexaconazole 5 Sc (T4) with 16.21% PDI and SV + 1/2 RDN + single spray of Hexaconazole 5 Sc (T6) with 16.67% PDI and followed by SV + 100% RDN + single spray of Hexaconazole 5 Sc (T2) treatment with 25.93% PDI, SV + 2/3rd RDN + single spray of Hexaconazole 5 Sc (T3) treatment with 29.63% PDI and SV + 2/3rd RDN (T1) treatment with 34.72% PDI. The maximum PDI (37.50%) was recorded in control in SV + 100% RDN (T8) treatment.

Results (table no. 2) showed that on thirty day of inoculation of sheath blight disease, minimum disease severity was recorded with a PDI of 31.95% in SV + 1/2 RDN + three spray of Hexaconazole 5 Sc (T7) treatment and was significantly reduced the sheath blight disease and was statistically on par with SV + 2/3rd RDN + three spray of Hexaconazole 5 Sc (T5) treatment with 32.41% PDI and SV + 100% RDN + three spray of Hexaconazole 5 Sc (T4) treatment with 35.65% PDI followed by SV + 1/2 RDN + single spray of Hexaconazole 5 Sc (T6) treatment with 41.20% PDI, SV + 2/3rd RDN + single spray of Hexaconazole 5 Sc (T3) treatment with 42.59% PDI, SV + 100% RDN + single spray of Hexaconazole 5 Sc (T2) treatment with 53.70% PDI and SV + 2/3rd RDN (T1) treatment with 71.75% PDI over the control treatment. The maximum PDI (72.22%) was recorded in control in SV + 100% RDN (T8) treatment.

During the final observation on 40 DAI (table no. 2) of sheath blight disease, all treatments of disease management practices combined with different doses of Nitrogen fertilizer significantly superior to reduce the sheath blight severity over control treatment. Minimum percent disease index 32.41% was recorded in SV + 1/2 RDN + three spray of Hexaconazole 5 Sc (T7) and was significantly reduced the sheath blight disease severity over all treatments which was statistically on par with SV + 2/3rd RDN + three spray of Hexaconazole 5 Sc (T5) with 33.34% PDI followed by SV + 100% RDN + three spray of Hexaconazole 5 Sc (T4) with 37.04% PDI, SV + 1/2 RDN + single spray of Hexaconazole 5 Sc (T6) with 38.89% PDI, SV + 2/3rd RDN + single spray of Hexaconazole 5 Sc (T3) with 48.61% PDI, SV + 100% RDN + single spray of Hexaconazole 5 Sc (T2) with 54.63% PDI and SV + 2/3rd RDN (T1) treatments with 69.91% PDI. Control treatment SV + 100% RDN (T8) showed the maximum percent disease index (74.54%).

All treatments of disease management practices combined with different doses of Nitrogen fertilizer significantly increased the yield over control treatment. Maximum grain yield (4672.47 kg/ha.) was also recorded in SV + 1/2 RDN + three spray of Hexaconazole 5 Sc (T7) treatment and was significantly superior among all treatments which is on par with SV + 2/3rd RDN + three spray of Hexaconazole 5 Sc (T5) treatment (4608.37 kg/ha.) followed by SV + 100% RDN + three spray of Hexaconazole 5 Sc (T4) treatment (4416.24 kg/ha.), SV + 1/2 RDN + single spray of Hexaconazole 5 Sc (T6) treatment (4320.14 kg/ha.), SV + 2/3rd RDN + single spray of Hexaconazole 5 Sc (T3) treatment (4288.17 kg/ha.), SV + 100% RDN + single spray of Hexaconazole 5 Sc (T2) treatment (4096.0 kg/ha.) and SV + 2/3rd RDN (T1) treatment (3744.60 kg/ha.) over the control. The minimum yield (3616.24 kg/ha.) was recorded with control treatment.

Table 2: The efficacy of disease management practices combined with different doses of 'N' fertilizer (Year-2017)

Treatment No.	Treatments	Percent Disease Index (PDI) 15 DAI	Percent Disease Index (PDI) 30 DAI	Percent Disease Index (PDI) 40 DAI	Yield (Kg/ha)
T1	SV + 2/3rd RDN	34.72 (36.09)	71.75 (58.07)	69.91 (56.95)	3744.60
T2	SV + 100% RDN + single spray of Hexaconazole 5 Sc	25.93 (30.33)	53.70 (47.12)	54.63 (47.66)	4096.0
T3	SV + 2/3rd RDN + single spray of Hexaconazole 5 Sc	29.63 (32.89)	42.59 (40.68)	48.61 (44.20)	4288.17
T4	SV + 100% RDN + three spray of Hexaconazole 5 Sc	16.21 (23.54)	35.65 (36.64)	37.04 (37.48)	4416.24
T5	SV + 2/3rd RDN + three spray of Hexaconazole 5 Sc	11.58 (19.89)	32.41 (34.70)	33.34 (35.27)	4608.37
T6	SV + 1/2 RDN + single spray of Hexaconazole 5 Sc	16.67 (23.59)	41.20 (39.85)	38.89 (38.58)	4320.14
T7	SV + 1/2 RDN + three spray of Hexaconazole 5 Sc	11.12 (19.48)	31.95 (34.41)	32.41 (34.70)	4672.47
T8	SV + 100% RDN (Control)	37.50 (41.50)	72.22 (58.35)	74.54 (59.70)	3616.24
SV	Swarna				
Spray	3				
	SE(m)+-	2.1063	2.607	1.4588	31.127
	CD (5%)	6.3887	7.9076	4.4248	94.414
	CV	12.8391	10.32	5.7017	1.2774
	S.Ed	2.9787	3.6869	2.0630	44.020

*Figures in Parenthesis are sine transformed value

Pooled data of kharif 2016 and kharif 2017 presented in the table no. 3 and fig. 1 on 15th day of inoculation revealed that minimum percent disease index (11.12%) was recorded in SV + 1/2 RDN + three spray of Hexaconazole 5 Sc (T7) treatment which showed significantly superior in reducing the sheath blight disease severity and was statistically on par with SV + 2/3rd RDN + three spray of Hexaconazole 5 Sc (T5) treatment with 11.35% PDI, SV + 100% RDN + three spray of Hexaconazole 5 Sc (T4) with 13.67% PDI and SV + 1/2 RDN + single spray of Hexaconazole 5 Sc (T6) with 13.90% PDI followed by treatment SV + 2/3rd RDN + single spray of Hexaconazole 5 Sc (T3) with 20.60% PDI, treatment SV + 100% RDN + single spray of Hexaconazole 5 Sc (T2) with 21.07% PDI and treatment SV + 2/3rd RDN (T1) with 32.64% PDI over the control. The maximum percent disease index (36.35%) was recorded in control treatment SV + 100% RDN (T8).

Results (table no. 3 and fig. 2) showed that on thirty day of inoculation, minimum percent disease index (21.54%) was recorded in SV + 1/2 RDN + three spray of Hexaconazole 5 Sc (T7) treatment and was significantly reduced the disease severity which is followed by SV + 2/3rd RDN + three spray of Hexaconazole 5 Sc (T5) treatment with 32.88% PDI, SV + 100% RDN + three spray of Hexaconazole 5 Sc (T4) treatment with 33.68% PDI, SV + 1/2 RDN + single spray of Hexaconazole 5 Sc (T6) treatment with 37.27% PDI, SV + 2/3rd RDN + single spray of Hexaconazole 5 Sc (T3) treatment with 41.21% PDI, SV + 100% RDN + single spray of Hexaconazole 5 Sc (T2) treatment with 50.23% PDI, SV + 2/3rd RDN (T1) treatment with 63.65% PDI. The maximum percent disease index (64.24%) was recorded in control (T8) treatment SV + 100% RDN.

During the final observation *i.e.* at 40 DAI of sheath blight disease (table no. 3 and fig. 3) showed all treatments of disease management practices combined with different doses of Nitrogen fertilizer significantly superior to reduce the

sheath blight severity over control treatment. Among the treatments, minimum percent disease index (32.88%) was recorded in treatment SV + 1/2 RDN + three spray of Hexaconazole 5 Sc (T7) which was found significantly superior and on par with SV + 2/3rd RDN + three spray of Hexaconazole 5 Sc (T5) with 34.03% PDI and SV + 100% RDN + three spray of Hexaconazole 5 Sc (T4) with 34.72% PDI followed by SV + 1/2 RDN + single spray of Hexaconazole 5 Sc (T6) treatment with 37.49% PDI, SV + 2/3rd RDN + single spray of Hexaconazole 5 Sc (T3) treatment with 51.62% PDI, SV + 100% RDN + single spray of Hexaconazole 5 Sc (T2) treatment with 54.41% PDI, SV + 2/3rd RDN (T1) treatment with 63.67% PDI. The maximum percent disease index (75.93%) was recorded in control (T8) treatment SV + 100% RDN.

All treatments of disease management practices combined with different doses of Nitrogen fertilizer significantly increased the yield over control treatment. Maximum grain yield (4576.35 kg/ha.) was recorded in SV + 1/2 RDN + three spray of Hexaconazole 5 Sc (T7) treatment and was significantly superior over all treatments and which is statistically on par with SV + 2/3rd RDN + three spray of Hexaconazole 5 Sc (T5) treatment (4512.42 kg/ha.) followed by SV + 100% RDN + three spray of Hexaconazole 5 Sc (T4) treatment (4368.12 kg/ha.), SV + 1/2 RDN + single spray of Hexaconazole 5 Sc (T6) treatment (4272.07 kg/ha.), SV + 2/3rd RDN + single spray of Hexaconazole 5 Sc (T3) treatment (4224.09 kg/ha.), SV + 100% RDN + single spray of Hexaconazole 5 Sc (T2) treatment (4048.20 kg/ha.) and SV + 2/3rd RDN (T1) treatment (3712.30 kg/ha.) as compared to the control treatment. The minimum yield (3584.33 kg/ha.) was recorded with control treatment.

Similar findings also reported by Anonymous (2009) that the integration of disease management practices like growing disease specific resistant/moderately resistant or susceptible variety with 100% or 2/3rd RDN along with need based fungicidal protection in case of fungal diseases like blast and sheath blight and nitrogen management in case of Bacterial leaf blight are promising in checking the disease severity/incidence and improving the grain yield. Use of excessive Nitrogen fertilizer has been observed to increase sheath blight damage to rice was also reported by Slaton *et al*, 2003 [17]. Jagat Janni (2011) [8] evaluated the disease management practices combined with different doses of nitrogen fertilizer and observed the significant decrease in sheath blight severity and increase in yield in Resistant variety and 100% recommended dose of nitrogen fertilizer with different doses of hexaconazole were the effective practice. Dev and Mary (1982) [5] reported that heavy application of nitrogen fertilizer increases the number of tillers/plant and this leads to an increase in relative humidity of the plant microclimate thereby favouring the development of sheath blight. Under high nitrogen levels, even the traditional tall indica cultivars are rated as susceptible to highly susceptible.

Table 3: The efficacy of disease management practices combined with different doses of 'N' fertilizer (Pooled data of kharif 2016 and kharif 2017):

Treatment No.	Treatments	Percent Disease Index (PDI) 15 DAI	Percent Disease Index (PDI) 30 DAI	Percent Disease Index PDI) 40 DAI	Yield (Kg/ha)
T1	SV + 2/3rd RDN	32.64 (34.82)	63.65 (53.03)	63.67 (52.95)	3712.30
T2	SV + 100% RDN + single spray of Hexaconazole 5 Sc	21.07 (27.10)	50.23 (45.14)	54.41 (47.52)	4048.20
T3	SV + 2/3rd RDN + single spray of Hexaconazole 5 Sc	20.60 (26.95)	41.21 (39.90)	51.62 (45.93)	4224.09
T4	SV + 100% RDN + three spray of Hexaconazole 5 Sc	13.67 (21.63)	33.68 (35.47)	34.72 (37.07)	4368.12
T5	SV + 2/3rd RDN + three spray of Hexaconazole 5 Sc	11.35 (19.69)	32.88 (34.98)	34.03 (35.68)	4512.42
T6	SV + 1/2 RDN + single spray of Hexaconazole 5 Sc	13.90 (21.71)	37.27 (37.59)	37.49 (37.76)	4272.07
T7	SV + 1/2 RDN + three spray of Hexaconazole 5 Sc	11.12 (19.48)	21.54 (27.64)	32.88 (34.98)	4576.35
T8	SV + 100% RDN (Control)	36.35 (37.07)	64.24 (53.28)	75.93 (60.62)	3584.33
SV	Swarna				
Spray	3				
	SE(m)+-	1.3844	1.2871	0.6516	22.855
	CD (5%)	4.1992	3.9041	1.9765	69.323
	CV	9.2027	5.4525	2.5611	0.9510
	SEd	1.9578	1.8202	0.9215	32.3218

*Figures in Parenthesis are sine transformed value

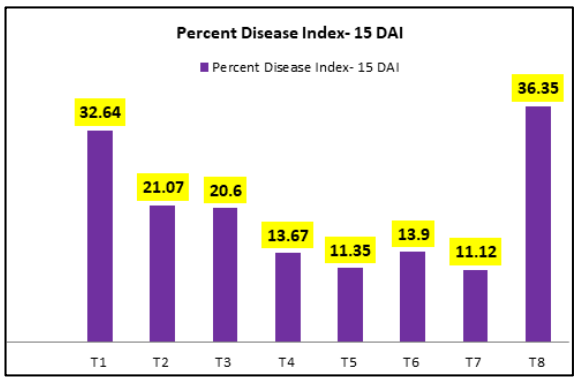

Fig 1: The efficacy of disease management practices combined with different doses of 'N' fertilizer (Pooled data of kharif 2016 and kharif 2017)

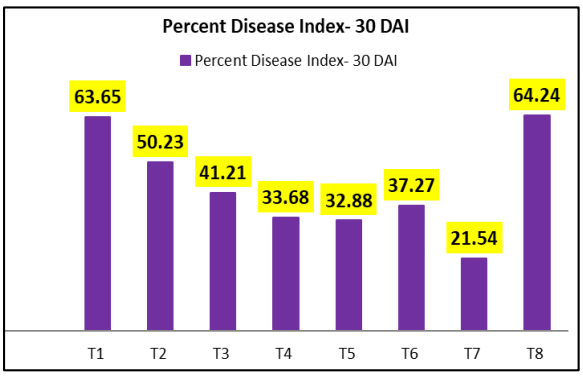

Fig 2: The efficacy of disease management practices combined with different doses of 'N' fertilizer (Pooled data of kharif 2016 and kharif 2017)

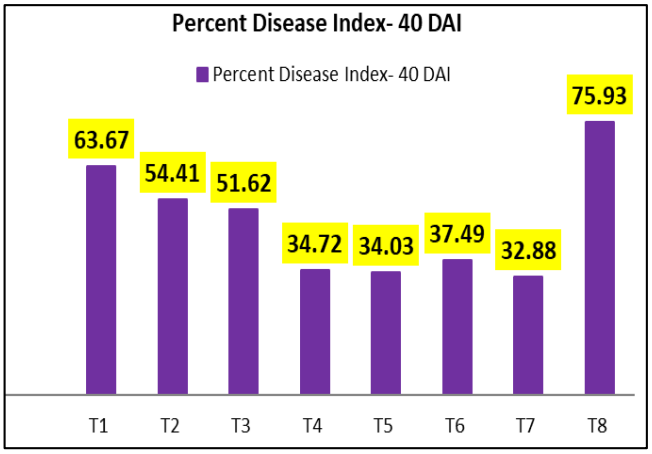

Fig 3: The efficacy of disease management practices combined with different doses of 'N' fertilizer (Pooled data of kharif 2016 and kharif 2017)

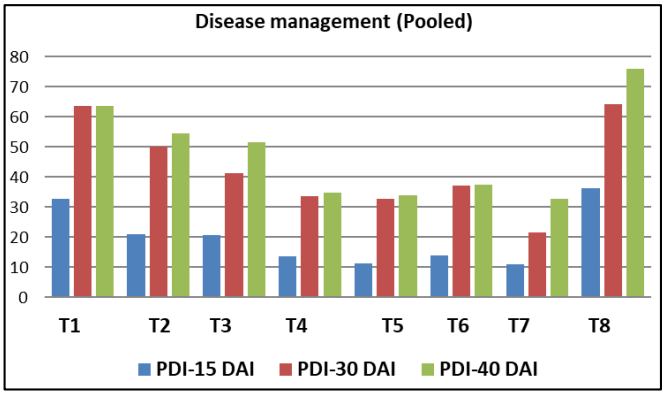

Fig 4: The efficacy of disease management practices combined with different doses of 'N' fertilizer (Pooled data of kharif 2016 and kharif 2017)

Conclusion

Disease management practices in combination with different doses of nitrogen fertilizer revealed that treatment of SV + 1/2 RDN + three spray of Hexaconazole 5 Sc significantly reduce the sheath blight disease severity (with 32.88% PDI) and increased the yield (4576.35 kg/ha) over control treatment. The maximum percent disease index (75.93%) and minimum yield (3584.33 kg/ha) were recorded with control treatment. It was noted that SV + 1/2 RDN + three spray of Hexaconazole 5 Sc reduce the sheath blight severity and increased the yield.

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