

Original Research Article

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## Survey for the Assessment and Effect of Different Levels of N- Fertilizers and Spacing on Incidence of False Smut of Rice

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### ABSTRACT

Surveys were carried out in eight districts of Jharkhand. Hill infestation, tiller infestation and infected grains with false smut of rice were recorded higher in hybrid rice in comparison to none hybrid (HYV) rice in all surveyed areas of Jharkhand. Hill infestation with false smut of rice ranged from 3.8 to 31.7 % in twenty one rice cultivars. Highest tiller infestation with false smut was recorded in Arize 6444 (24.8%), followed by PAC 801 (22.5%), KRH 2 (22.3%), 25P25 (21.7%) and PHB 71 (20.3%). Highest false smut infected grains/panicle was recorded in PAC 801 (8.6) followed by Arize 6444 (8.2). Application of higher level of N-fertilizer in rice recorded higher tiller infestation of false smut of rice, higher number of false smut infected grains /panicle and higher hill infestation of false smut of rice during 2016 and 2017 crop seasons. Closer spacing in rice recorded higher tiller infestation of false smut of rice, higher number of false smut infected grains/ panicle and higher hill infestation of false smut of rice in all three levels N-fertilizers i.e., 90, 120 and 150 Kg N ha<sup>-1</sup> during above two crop seasons. False smut symptom was observed on all three levels of nitrogen having five spacing of rice in both 2014 and 2015 crop seasons. Highest mean grain yield of 78.5 q ha<sup>-1</sup> was recorded in plots where N- fertilizer was applied @120 Kg ha<sup>-1</sup> and spacing of rice was 25 cm X 25 cm, this treatment also recorded mean tiller infestation of 7.8%, lowest mean infected grains/panicle of 6.3 and lowest mean hill infestation of 11.7%. This treatment was at par with treatment having N- fertilizers was applied @ 120 Kg ha<sup>-1</sup> and spacing of 20 cm X 20 cm, which recorded mean grain yield of 77.0 q ha<sup>-1</sup>, mean tiller infestation of 9.1% and mean hill infestation of 6.6%.

### Keywords

False smut, management, nitrogenous fertilizer, *Oryza sativa*, spacing, *Ustilagoidea virens*

### Article Info

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### Introduction

False smut of rice (*Oryza sativa* L.) caused by *Cleviceps oryzae-sativae* Hashioka (Imperfect stage – *Ustilagoidea virens*

[(Cooke) Takahashi] Hitherto is one of the major production constraints in HYV/ Hybrid rice in all over the world. In India, the disease was called as ‘Lakshmi’ disease as an indication of bumper harvest. In recent

decades, the area of hybrid rice cultivation is increasing in India, particularly in Jharkhand State (Pandey and Singh, 2013). In earlier days false smut was considered as a minor disease in rice but now-a-days it is being frequently recorded as a major disease, particularly in hybrid rice growing areas of Jharkhand, causing heavy loss of rice yield both in terms of quality and quantity (Barnwal and Singh, 2011; Barnwal *et al.*, 2016). High incidences of false smut in rice are correlated with increase in many parameters involved in rice production system. These include heavy application of nitrogenous fertilizers, use of responsive cultivars and change in climatic condition *etc.* associated with modern rice production system (Savary *et al.*, 2004; Barnwal *et al.*, 2018).

HYVs and hybrids are more prone to false smut of rice. Due to this disease of rice, yield loss was recorded up to 49% in India (Ladhalakshmi, 2012; Kumari and Kumar, 2015). However, differences appear to be from different maturity dates instead of true varietal resistance (Ou, 1985). At present farmers are applying various level of nitrogenous fertilizer and different spacing in rice cultivation in many districts of Jharkhand State. Disease suppression through optimizing N- fertilizer and spacing in rice and other crops have been reported by many workers (Long *et al.*, 2000; Riba *et al.*, 2011; Kumar and Yadav, 2012). Therefore, attempt has been made to identify optimum dose of N- fertilizer and spacing for suppressing false smut disease of rice as an IDM component.

## Materials and Methods

Random survey of rice was conducted at farmers' field of rice growing areas in different villages of eight districts (Ranchi, Lohardaga, Gumla, Khunti, Ramgar, East Singhbhum, West Singhbhum and Saraikela-Kharsawan) of Jharkhand during Kharif, 2014

and 2015 to know the false smut incidence of rice. In each district two to five blocks were randomly selected. Three to five villages were surveyed from each block. In each village five to eight farmers' field having one m<sup>2</sup> areas each was selected for observation of tiller infestation, false smut infected grains/ panicle and Hill infestation with false smut disease. Ten each smutted and unsmutted (Healthy) panicles were randomly collected from each genotype and grain weight of ten panicles was recorded (Upadhyay and Singh, 2013). The specimens were collected from different locations and collected samples were wrapped in cellophane paper and brought to the laboratory for further studies.

Field trials were conducted during *Kharif* season, 2016 and 2017 at Darisai research farm of Birsa Agriculture University, Ranchi, Jharkhand.

The trials were laid out in split plot design with three replications. Twenty days old seedlings of susceptible hybrid rice (Arize 6444 Gold) were transplanted @ one seedling per hill in 4<sup>th</sup> week of July in the main field of the crop.

The plot size was 5.0 m X 4.0 m. The distance between two replications and plot to plot were one meter each. Phosphorus and Potassic (P<sub>2</sub>O<sub>5</sub>: K<sub>2</sub>O) fertilizers were applied @ 60:90 Kg ha<sup>-1</sup> each plot. The treatments were three different doses of Nitrogenous (N) fertilizers *i.e.*, 90, 120 and 150 Kg ha<sup>-1</sup> were applied treated as a main plots and sub plots of five different spacing *i.e.*, 20 X 10 cm<sup>2</sup>, 20 X 15 cm<sup>2</sup>, 20 X 20 cm<sup>2</sup>, 25 X 25 cm<sup>2</sup> and 15 X 15 cm<sup>2</sup> as mentioned in Table 1. The plots were fertilized with FYM one ton ha<sup>-1</sup> and full dose of Phosphatic and potassic fertilizers were applied at the time of transplanting as a basal application. Although 1/3<sup>rd</sup> nitrogenous fertilizer was applied as basal and rest nitrogenous fertilizer was given in two split

doses *i.e.*, 25 and 50 DAT (Days after transplanting). The necessary agronomic inputs were provided during the crop season. All possible care was taken to prevent insect pest attack by spraying of suitable insecticides according to the necessity. Observations were made as tiller infestation (%) by dividing the total number of infected tillers to the total number of tillers/ m<sup>2</sup> per plot multiplied by 100. Number of infected grains with false smut/panicle were recorded randomly taken 20 smutted panicles per plot at five days before harvesting, whereas, Hill infestation (%) were observed by cress cross method of 20 hills per plot. Grain yield was also recorded for each plot after harvesting, threshing and eight days sun drying.

## Results and Discussion

Hill infestation, tiller infestation and infected grains with false smut of rice were recorded higher in hybrids in comparison to open pollinated varieties of rice in all surveyed area of Jharkhand. Hill infestation with false smut of rice ranged from 3.8 to 31.7 per cent in twenty one rice varieties /hybrids of eight above surveyed districts of Jharkhand.

Highest tiller infestation with false smut was recorded in Arize 6444 (24.8%) followed by PAC 801 (22.5%), KRH 2 (22.3%), 25P25 (21.7%) and PHB 71 (20.3%) whereas, lowest tiller infestation was recorded in IR-64. Highest false smut infected grains/panicle was recorded in PAC 801 (8.6) followed by Arize 6444 (8.2), KRH 2 (7.8), 25P25 (7.3) and 27P52 (7.0). Maximum decrease in weight of ten panicles was observed in Arize 6444 (13.6 g) followed by KRH 2 (10.1 g), PAC 801 (10.0 g) (Table 1).

Barnwal and Singh (2011) reported the infection of false smut of 68.06% on HKR and 36% on PA 6444. Ladhakshmi (2012) reported that false smut incidence was very high on hybrids (PA 6444 and PA 6129) in

Haryana, while incidence of disease on PR 114 and PR 116 was higher in Punjab.

## N-level

False smut of rice was observed on all three levels of N- fertilizer applied in field during both 2016 and 2017 crop seasons. Application of higher level of N-fertilizer in rice recorded higher tiller infestation of false smut of rice, higher number of false smut infected grains /panicle and higher hill infestation of false smut of rice during above two years.

Highest mean grain yield of 73.0 q ha<sup>-1</sup> was recorded When nitrogenous fertilizers was applied @ 120 Kg N ha<sup>-1</sup> (F2), this treatment also recorded mean tiller infestation of 10.9%, infected grains per panicle of 8.3 and hill infestation of 16.8%. This treatment was followed by F1 *i.e.*, 150 Kg N ha<sup>-1</sup> which recorded mean grain yield of 70.2 q ha<sup>-1</sup>, tiller infestation of 13.4%, false smut infected grains/ panicle of 9.7 and hill infestation of 19.9%. The F3 treatment (90 Kg N ha<sup>-1</sup>) recorded mean grain yield of 55.9 q ha<sup>-1</sup>, mean tiller infestation of 8.6 %, false smut infected grains/ panicle of 6.3 and hill infestation of 14.1% (Table 2). The present findings corroborates with earlier work of Kabat and Satapathy (2013); Pandey *et al.*, (2008). Long *et al.*, (2000) is also in accordance with our present findings who have reported that the incidence of rice blast increased with increasing levels of nitrogen.

## Spacing

False smut of rice was observed on all five spacing of rice in both 2016 and 2017 crop seasons. Closer spacing in rice recorded higher tiller infestation of false smut of rice, higher number of false smut infected grains /panicle and higher hill infestation of false smut of rice in all three levels N-fertilizers during above two years.

**Table.1** Survey for the assessment of false smut (*Ustilagoidea virens*) incidence of different rice cultivars in Jharkhand

Variety/ Hybrid	*Hill Infestation (%)	*Tiller infestation (%)	*No. of Infected grains/panicle (%)	*Grain weight of 10 Panicles (g)		Difference in weight (g)
				Unsmutted	Smutted	
<b>Arize 6444</b>	31.7	24.8	8.2	46.8	32.4	14.4
<b>Arize Tej</b>	22.3	18.2	6.4	41.2	32.0	9.2
<b>DRRH 2</b>	16.0	18.3	6.8	41.2	32.3	8.9
<b>KRH 2</b>	27.3	22.3	7.8	38.8	28.7	10.1
<b>27P52</b>	26.3	20.2	7.0	39.5	30.1	9.4
<b>25P25</b>	29.3	21.7	7.3	38.8	31.6	7.2
<b>PHB 71</b>	25.3	20.3	5.4	41.6	33.4	8.2
<b>27P31</b>	17.0	19.7	6.3	43.2	35.6	7.6
<b>PAC 801</b>	27.7	22.5	8.6	40.8	30.8	10.0
<b>US 314</b>	19.5	18.3	6.8	37.5	30.2	7.3
<b>Rajendra Mehsuri</b>	17.7	14.0	5.7	36.8	27.8	9.0
<b>Birsamati</b>	18.0	12.2	5.6	32.6	24.5	6.1
<b>Naveen</b>	9.7	8.7	2.5	29.8	21.7	8.1
<b>Swarna</b>	14.3	11.3	4.8	40.6	30.7	9.9
<b>Lalat</b>	6.7	4.8	3.1	37.6	29.8	7.8
<b>Abhisek</b>	5.3	3.8	1.8	35.4	29.2	6.2
<b>MTU 1010</b>	8.7	7.2	2.2	37.9	32.2	5.7
<b>IR 64</b>	3.8	3.2	1.7	39.8	31.6	8.2
<b>MTU 1001</b>	12.7	6.7	3.3	36.7	32.6	6.1
<b>Sahbhagi</b>	5.6	3.1	2.3	38.5	31.3	7.2
<b>BVD 110</b>	4.8	3.6	1.9	37.6	31.2	6.4

\*Mean of two years data (2014 and 2015)

**Table.2** Evaluation of different levels of nitrogenous fertilizer on incidence of false smut disease and grain yield of rice

Treatments (N- Fertilizer)	*Tiller infestation (%)			*Number of infected grains/panicle			*Hill infestation (%)			*Grain yield (q/ha)		
	2016	2017	Mean	2016	2017	Mean	2016	2017	Mean	2016	2017	Mean
<b>F1</b>	12.9 (20.5)	13.8 (21.6)	13.4 (21.1)	8.5	10.9	9.7	22.3 (27.7)	17.4 (24.0)	19.9 (25.9)	69.2	71.1	70.2
<b>F2</b>	10.2 (18.4)	11.6 (19.8)	10.9 (19.1)	7.5	9.1	8.3	18.9 (25.5)	14.7 (22.3)	16.8 (23.9)	72.3	73.7	73.0
<b>F3</b>	8.2 (16.6)	9.0 (17.6)	8.6 (17.1)	5.8	6.7	6.3	15.9 (23.1)	12.3 (20.1)	14.1 (21.6)	56.8	55.1	55.9
<b>CD at 5%</b>	2.1	2.80	2.6	NS	2.81	NS	NS	2.42	NS	5.78	3.40	4.82
<b>CV(%)</b>	19.7	11.8	16.3		17.60			17.50		17.60	15.10	16.5

Where F1- 150 Kg N ha<sup>-1</sup> F2 - 120 Kg N ha<sup>-1</sup> F3- 90 Kg N ha<sup>-1</sup> Mean of three replications Figures in parentheses are transformed arc sine value

**Table.4.1** Evaluation of different levels of nitrogenous fertilizer and spacing on incidence of false smut of rice

Treatments (Spacing)	*Tiller infestation (%)			*Number of infected grains/panicle			*Hill infestation (%)			*Grain yield (q/ha)		
	2016	2017	Mean	2016	2017	Mean	2016	2017	Mean	2016	2017	Mean
<b>S1</b>	13.9 (21.6)	10.7 (18.9)	12.3 (20.3)	8.6	11.8	10.4	24.6 (29.0)	18.9 (25.6)	21.8 (27.3)	61.3	60.7	61.0
<b>S2</b>	10.6 (18.8)	9.0 (17.4)	9.8 (18.1)	8.0	9.5	8.8	20.0 (26.0)	16.1 (23.5)	18.1 (24.8)	65.3	66.9	66.6
<b>S3</b>	7.8 (16.1)	8.3 (16.7)	8.1 (16.4)	6.3	7.1	6.7	17.2 (24.4)	11.2 (19.1)	14.2 (12.8)	69.3	70.0	69.7
<b>S4</b>	6.7 (14.8)	4.5 (14.8)	5.6 (14.8)	4.4	6.5	5.5	11.6 (19.6)	10.5 (18.2)	11.1 (18.9)	73.9	72.4	73.2
<b>S5</b>	12.8 (20.7)	12.3 (20.4)	12.6 (20.6)	8.9	9.4	9.2	21.6 (27.3)	17.2 (24.3)	19.4 (25.8)	60.7	63.2	62.0
<b>CD at 5%</b>	3.4	2.3	3.1	NS	1.8	NS	4.79	3.8	4.5	6.8	7.2	7.1
<b>CV (%)</b>	18.6	14.1	16.6		24.1		12.9	12.9	12.9	11.0	15.1	14.3

Where S1- 20cm X 10cm , S2- 20cm X15cm, S3- 20cm X20cm S4- 25cm X25cm and S5- 15cm X15cm \*Mean of three replications  
Figures in parentheses are transformed into arc sine value

**Table.4.2** Evaluation of different levels of nitrogenous fertilizer and spacing on incidence of false smut of rice

Fi	*Tiller infestation (%)											
	F1			F2			F3			Mean		
Si	2016	2017	Mean	2016	2017	Mean	2016	2017	Mean	2016	2017	Mean
<b>S1</b>	19.7 (26.1)	19.7 (26.1)	19.7 (26.1)	11.6 (19.9)	14.7 (22.5)	13.0 (21.2)	10.3 (18.8)	10.7 (18.9)	10.5 (18.9)	13.9 (21.6)	15.0 (22.5)	14.5 (22.1)
<b>S2</b>	12.3 (20.2)	13.0 (21.1)	12.4 (20.7)	10.7 (18.9)	11.0 (19.2)	10.9 (19.1)	8.8 (17.3)	9.0 (17.4)	8.9 (17.3)	10.6 (18.8)	11.0 (19.2)	10.8 (19.0)
<b>S3</b>	9.0 (17.3)	11.0 (19.3)	10.0 (18.3)	7.8 (16.1)	10.3 (18.7)	9.1 (17.4)	6.6 (14.9)	8.3 (16.7)	7.5 (15.8)	7.8 (16.1)	9.9 (18.2)	8.9 (17.7)
<b>S4</b>	8.3 (16.5)	10.3 (18.6)	9.3 (17.6)	7.3 (15.5)	8.3 (16.7)	7.8 (16.1)	4.5 (12.3)	4.5 (14.8)	4.5 (13.6)	6.7 (14.8)	7.7 (16.7)	7.2 (15.8)
<b>S5</b>	15.0 (22.4)	15.0 (22.4)	15.0 (22.4)	12.7 (20.7)	13.7 (21.7)	13.2 (21.2)	10.7 (19.0)	12.3 (20.4)	11.5 (19.7)	12.8 (20.7)	13.7 (21.6)	13.3 (21.2)
<b>Mean</b>	12.9 (20.5)	13.8 (21.6)	13.4 (21.1)	10.2 (18.4)	11.6 (19.8)	10.9 (19.1)	8.2 (16.4)	9.0 (17.6)	17.1 (17.0)			
<b>CD at 5%</b>				2015	2016	Mean						
	F <sub>1</sub> -F <sub>3</sub> -			2.10	2.80	2.63						
	S <sub>1</sub> -S <sub>5</sub> -			3.44	2.30	3.10						
<b>CV (%)</b>	F <sub>1</sub> S <sub>1</sub> - F <sub>1</sub> S <sub>5</sub> -			NS	NS	NS						
	F <sub>1</sub> S <sub>1</sub> - F <sub>3</sub> S <sub>5</sub> -			NS	NS	NS						
	CV1-			19.7	11.8	16.3						
CV2-			18.6	14.1	16.6							
Where F1- 150 Kg N ha <sup>-1</sup> , F2 - 120 Kg N ha <sup>-1</sup> , F3- 90 Kg N ha <sup>-1</sup> ; S1- 20cm X 10cm, S2- 20cm X15cm, S3- 20cm X20cm S4- 25cm X25cm and S5- 15cm X15cm												
*Mean of three replications			Figures in parentheses are transformed into arc sine values									

**Table.4.3** Evaluation of different levels of nitrogenous fertilizer and spacing on incidence of false smut of rice

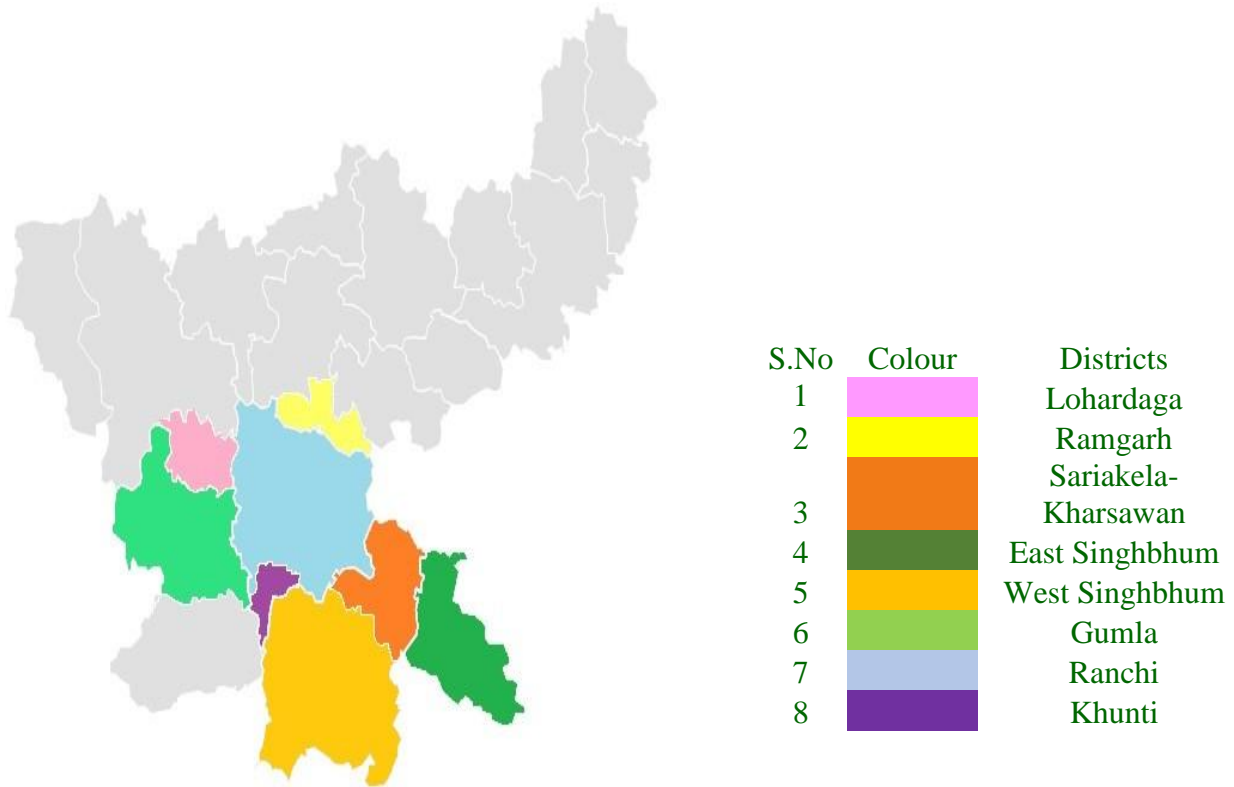
Fi	* Number of infected grains/panicle												
	F1			F2			F3			Mean			
Si	2016	2017	Mean	2016	20167	Mean	2016	2017	Mean	2016	2017	Mean	
S1	10.3	16.2	13.3	9.2	10.8	10.0	6.3	8.4	7.4	8.6	11.8	10.2	
S2	8.7	11.9	10.3	7.8	10.1	9.0	7.5	6.5	7.0	8.0	9.5	8.8	
S3	8.3	8.3	8.3	6.0	7.1	6.6	5.3	5.9	5.6	6.3	7.1	6.6	
S4	5.1	7.6	6.4	5.7	6.8	6.3	4.7	5.2	5.0	4.4	6.5	5.9	
S5	9.8	10.3	10.1	8.7	10.3	9.5	2.3	7.6	5.0	8.9	9.4	9.2	
Mean	8.5	10.9	9.7	7.5	9.1	8.3	5.8	6.7	6.3	7.24	8.86	8.14	
CD at 5%				2015	2016	Mean							
	F <sub>1</sub> -F <sub>3</sub> -			NS	2.8	NS							
	S <sub>1</sub> -S <sub>5</sub> -			NS	1.8	NS							
	F <sub>1</sub> S <sub>1</sub> - F <sub>1</sub> S <sub>5</sub> -			NS	3.1	NS							
CV (%)	F <sub>1</sub> S <sub>1</sub> - F <sub>3</sub> S <sub>5</sub>			NS	3.9	NS							
	CV1-						17.6						
	CV2-						24.1						
Where F1- 150 Kg N ha <sup>-1</sup> , F2 - 120 Kg N ha <sup>-1</sup> , F3- 90 Kg N ha <sup>-1</sup> ; S1- 20cm X 10cm, S2- 20cm X15cm, S3- 20cm X20cm, S4- 25cm X25cm and S5- 15cm X15cm													
*Mean of three replications                      Figures in parentheses are transformed into arc sine values													

**Table.4.4** Evaluation of different levels of nitrogenous fertilizer and spacing on grain yield of rice

Fi	* Hill infestation (%)											
	F1			F2			F3			Mean		
Si	2016	2017	Mean	2016	2017	Mean	2016	2017	Mean	2016	2017	Mean
<b>S1</b>	28.3 (31.1)	21.6 (27.6)	25.5 (29.4)	23.7 (28.7)	18.3 (25.0)	16.0 (26.9)	21.7 (27.2)	16.7 (24.1)	19.2 (25.2)	24.6 (29.0)	18.9 (25.6)	21.8 (27.3)
<b>S2</b>	21.7 (27.5)	18.3 (25.0)	20.0 (26.3)	18.3 (25.0)	15.0 (22.6)	16.7 (23.8)	20.0 (25.3)	15.0 (22.6)	17.5 (24.0)	20.0 (26.0)	16.1 (23.5)	18.1 (24.8)
<b>S3</b>	20.0 (26.5)	13.7 (21.3)	16.4 (23.9)	16.7 (24.1)	11.7 (19.9)	14.2 (22.0)	15.0 (22.6)	8.3 (16.2)	11.7 (19.4)	17.2 (24.4)	11.2 (19.1)	14.2 (21.8)
<b>S4</b>	15.0 (22.6)	13.3 (19.9)	14.2 (16.3)	11.7 (19.9)	11.7 (19.9)	11.7 (19.9)	8.3 (16.2)	6.7 (14.8)	7.5 (15.5)	11.6 (19.6)	10.5 (18.2)	11.1 (18.9)
<b>S5</b>	26.7 (30.9)	20.0 (26.1)	23.4 (28.5)	25.0 (29.7)	16.7 (24.1)	20.9 (26.9)	13.3 (21.1)	15.0 (22.6)	14.2 (21.9)	21.6 (27.3)	17.2 (24.3)	19.4 (25.8)
<b>Mean</b>	22.3 (27.7)	17.4 (24.0)	19.9 (25.9)	18.9 (25.5)	14.7 (22.3)	16.8 (23.9)	15.9 (23.1)	12.3 (20.1)	14.0 (21.2)	19.0 (25.6)	14.8 (22.1)	16.9 (23.7)
<b>CD at 5%</b>				2015	2016	Mean						
	F <sub>1</sub> -F <sub>3</sub> -			NS	2.42	NS						
	S <sub>1</sub> -S <sub>5</sub> -			NS	3.80	NS						
	F <sub>1</sub> S <sub>1</sub> - F <sub>1</sub> S <sub>5</sub> -			NS	NS	NS						
<b>CV (%)</b>	F <sub>1</sub> S <sub>1</sub> - F <sub>3</sub> S <sub>5</sub>			NS	NS	NS						
	CV1-						17.5					
CV2-						12.9						
Where F1- 150 Kg N ha <sup>-1</sup> F2 - 120 Kg N ha <sup>-1</sup> F3- 90 Kg N ha <sup>-1</sup> ; S1- 20cm X 10cm , S2- 20cm X15cm, S3- 20cm X20cm S4- 25cm X25cm and S5- 15cm X15cm												
*Mean of three replications			Figures in parentheses are transformed into arc sine values									



**Fig.1** Map showing survey assessment of false smut (*Ustilaginoidea virens*) incidence of different rice cultivars in different districts of Jharkhand



Highest mean grain yield of 73.2 q ha<sup>-1</sup> was recorded in plots having spacing of rice was 25cm X 25cm (S4), this treatment also recorded lowest mean tiller infestation of 5.6%, lowest mean infected grains/ panicle of 5.5 and lowest mean hill infestation of 11.1%. This treatment was at par with S3 *i.e.*, spacing of 20 X 20 cm, which recorded mean grain yield of 69.7 q ha<sup>-1</sup>, mean tiller infestation of 8.1%, mean infected grains/ panicle of 6.7 and mean hill infestation of 14.2%. The next best treatment in order of superiority was is S2 (20 cm X 15 cm) recorded mean grain yield of 66.6 q ha<sup>-1</sup>, mean tiller infestation of 9.8%, infected grains per panicle of 8.8 and hill infestation of 18.1% (Table 3). Pathak *et al.*, (2013) has also been observed that the incidence of false smut was significantly

lower in SRI system (25 cm X 25 cm) of rice cultivation in comparison to traditional system (20cm X 10cm) of rice cultivation. Grain and straw yields were also higher SRI in comparison to traditional system of rice cultivation. Riba *et al.*, (2011) who also reported higher incidence of fungal diseases in traditional system of rice cultivation in comparison to SRI method of rice cultivation in North Eastern region

### Nitrogen X Spacing of rice

Symptom of false smut was observed on all three doses of nitrogen having five spacing of rice in both 2016 and 2017 crop seasons. Highest mean grain yield of 78.5 q ha<sup>-1</sup> was recorded in plots where N-fertilizer was

applied @120 Kg ha<sup>-1</sup> and Spacing of rice was 25cm X 25cm (S4), this treatment also recorded mean tiller infestation of 7.8%, lowest mean infected grains per panicle of 6.3 and lowest mean hill infestation of 11.7%. This treatment was at par with treatment having N- fertilizer was applied @ 120 Kg ha<sup>-1</sup> and spacing of 20cm X 20cm, which recorded mean grain yield of 77.0 q ha<sup>-1</sup>, mean tiller infestation of 9.1%, mean infected grains per panicle of 6.6 and mean hill infestation of 14.2%. The next best treatment in order of superiority was is F1S4 *i.e.*, N-fertilizer was applied @150 Kg ha<sup>-1</sup> (F1) and spacing of rice was 25cm X 25cm (S4) which recorded mean grain yield of 76.2 q ha<sup>-1</sup>, mean tiller infestation of 9.3%, false smut infected grains per panicle of 6.4 and hill infestation of 14.2% (Table 4.1- 4.4). Similar findings have been recorded by various workers against rice and other crops (Long *et al.*, 2000; Riba *et al.*, 2011; Kumar and Yadav, 2012).

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