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Influence of N-Applied Through Integrated Organic and Inorganic Sources on Incidence of Diseases in Hybrid Rice

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Abstract

Pooled data of 2005-06 and 2006-07 crop seasons recorded least false smut disease with number of affected florets of 6.3 per panicle, panicle affected per cent of 8.2 and disease severity of 44.4%. The treatment recorded 14.5% of leaf blast, 9.8% of neck blast and 15.2% of brown spot in plots in which 90 kg nitrogen was applied in inorganic form (urea plus DAP) plus 20 kg nitrogen in the form of neem cake plus 10 kg nitrogen in the form of FYM in organic forms. This treatment also recorded mean maximum number of tillers/m^2 (542.5), plant height (132.2), panicle length (31.6), number of grains per panicle (326.2), highest grain and straw yields of 81.75 q/ha and 156.8 q/ha, respectively.

Key words : Rice diseases, Management, Grain yield, Inorganic, Organic N-fertilizers.

Relatively higher incidence of rice diseases following application of higher doses of N-fertilizers applied through inorganic sources have been reported in literature. Application of nitrogen through organic sources has been recommended to reduce the quantity applied in the inorganic form (1—3). Use of organic amendments is one of the successful methods for management of rice pathogens (4–6). The present paper reports incidence of diseases in hybrid rice in plots in which nitrogen was applied through integrated organic and inorganic sources.

Methods

Field trials were conducted during *kharif* of 2005-06 and 2006-07 crop seasons at Birsa Agricultural University, Zonal Research Station, Darisai Farm, in East Singhbhum district of Jharkhand State. The trials were undertaken under lowland (Don-1) ecology during both the crop seasons. The trials were laid out in randomized block design with three replications using the rice hybrid. Pro Agro-6444. Manures viz. farm yard manure (FYM), karanj oil cake and neem oil cake were used as sources of organic nitrogen. DAP and urea were used as inorganic nitrogen sources. The treatment details were as follows : T_1 – 60 kg N (urea + DAP) + 60 kg N (FYM), T_2 – 90 kg N (urea + DAP) + 30 kg N (neem oil cake), T_3 – 90 kg N (urea + DAP) + 30 kg N (karanj oil cake), T_4 – 90 kg N (urea + DAP) + 15 kg N (neem oil cake) + 15 kg N (karanj oil cake), T_5 – 90 kg N (urea + DAP) + 20 kg N (neem oil cake) + 10 kg N (FYM), T_6 –90 kg N (urea + DAP) + 20 kg N (karanj oil cake) + 10 kg N (FYM), T_7 – 100 kg N (urea + DAP) + 20 kg N (FYM) and T_8 – 120 kg N (urea + DAP).

Organic manures were incorporated into 5 m × 4 m sized plots as per the treatment, ten days before transplanting. Before application of neem oil cake, karanj oil cake and FYM in the field, total available nitrogen was estimated by standard method. The inorganic fertilizers (DAP/urea) were applied at transplanting, tillering and panicle initiation stages of the crop growth. Phosphorus and potash fertilizers were applied at 60:40 kg/ha at the time of transplanting. Twenty one days old seedlings were transplanted at 20 cm × 15 cm spacing, using one seedling per hill. All possible care was taken to prevent pest attack by spraying pesticides according to necessity.

Observations on severities of leaf blast and brown spot diseases were recorded by taking 50 leaves per plot randomly (7). Neck blast incidence was recorded at harvest by taking 100 panicles per plot randomly. Panicle affected with false smut was

Table 1. Influence of N-applied through integrated organic and inorganic sources on incidence of diseases of hybrid rice. *Mean of three replications. Figures in parentheses are transformed arc sine values.

Treatments	False smut*								
	No. of affected florets/panicle			Panicle affected (%)			Disease severity		
	2005-06	2006-07	Mean	2005-06	2006-07	Mean	2005-06	2006-07	Mean
T_1–60 kg N (urea + DAP) + 60 kg N (FYM)	5.6	7.1	6.4	12.7 (20.8)	8.3 (16.7)	10.5 (18.8)	70.7 (57.6)	58.5 (50.1)	64.6 (53.9)
T_2–90 kg N (urea + DAP) + 30 kg N (neem oil cake)	4.0	8.4	6.2	11.8 (20.0)	7.0 (15.3)	9.4 (17.7)	47.0 (43.3)	57.4 (49.3)	52.2 (46.3)
T_3–90 kg N (urea + DAP) + 30 kg N (karanj oil cake)	5.8	13.7	9.8	14.4 (22.3)	9.7 (18.1)	12.1 (20.2)	80.7 (68.5)	92.0 (82.9)	86.4 (75.7)
T_4–90 kg N (urea + DAP) + 15 kg N (neem oil cake) + 15 kg N (karanj oil cake)	5.3	9.3	7.3	12.2 (20.5)	9.3 (17.8)	10.8 (19.2)	64.6 (53.8)	76.5 (65.8)	70.6 (59.8)
T_5–90 kg N (urea + DAP) + 20 kg N (neem oil cake) + 10 kg N (FYM)	4.2	8.3	6.3	10.3 (18.7)	6.0 (16.0)	8.2 (17.4)	43.4 (41.2)	45.4 (42.2)	44.4 (41.7)
T_6–90 kg N (urea + DAP) + 20 kg N (karanj oil cake + 10 kg N (FYM)	6.4	12.9	9.7	13.7 (21.7)	11.7 (19.9)	12.7 (20.8)	86.7 (69.5)	100 (90.0)	93.4 (79.8)
T_7–100 kg N (urea + DAP) + 20 kg N (FYM)	6.3	9.8	8.1	15.4 (23.1)	12.3 (20.6)	13.9 (21.9)	87.3 (72.9)	97.8 (85.1)	92.6 (79.0)
T_8 – 120 kg N (urea + DAP) (control)	7.3	8.7	8.0	18.7 (25.6)	14.0 (22.0)	16.4 (23.8)	100.0 (90.0)	99.7 (89.5)	99.9 (89.8)
SE (±)	0.68	1.32	1.01	0.91	1.62	1.27	6.16	6.02	6.10
CD at 5%	2.07	3.99	3.06	2.76	4.93	3.85	18.7	18.3	18.5
CV%	22.2	23.3	22.9	7.68	16.7	19.1	18.09	15.8	17.1

computed by taking 100 panicles per plot randomly and number of florets affected with false smut per panicle was recorded taking 10 panicles per plot randomly. The disease severity of false smut was calculated by multiplying the per cent infected panicles with florets affected (8). Grain and straw yields were

Table 2. Influence of N-applied through integrated organic and inorganic sources on incidence of location specific diseases of hybrid rice. *Mean of three replications. Figures in parentheses are transformed arc sine values.

Treatments	Brown spot (%)*			Leaf blast (%)*			Neck blast (%)*		
	2005-06	2006-07	Mean	2005-06	2006-07	Mean	2005-06	2006-07	Mean
T_1 – 60 kg N (urea + DAP) + 60 kg N (FYM)	26.4 (30.9)	13.0 (21.1)	19.7 (26.0)	14.2 (22.1)	15.3 (23.0)	14.8 (22.6)	13.4 (21.4)	8.3 (16.6)	10.9 (19.0)
T_2 – 90 kg N (urea + DAP) + 30 kg N (neem oil cake)	10.7 (19.0)	6.0 (14.2)	8.4 (16.6)	12.8 (21.0)	11.0 (19.3)	11.9 (20.2)	12.8 (21.0)	11.0 (19.3)	10.9 (20.2)
T_3 – 90 kg N (urea + DAP) + 30 kg N (karanj oil cake)	23.2 (28.6)	14.0 (21.8)	18.6 (25.2)	17.5 (24.5)	16.0 (23.5)	16.8 (24.0)	12.0 (20.3)	8.7 (17.1)	10.4 (18.7)
T_4 – 90 kg N (urea + DAP) + 15 kg N (neem oil cake) + 15 kg N (karanj oil cake)	20.1 (26.6)	10.0 (18.0)	15.1 (22.3)	20.0 (26.6)	13.7 (21.5)	16.9 (24.1)	13.0 (21.1)	8.0 (16.1)	10.5 (18.6)
T_5 – 90 kg N (urea + DAP) + 20 kg N (neem oil cake) + 10 kg N (FYM)	21.3 (27.5)	9.0 (17.3)	15.2 (22.4)	15.7 (23.3)	13.3 (20.4)	14.5 (21.9)	12.3 (20.5)	7.3 (15.4)	9.8 (18.0)
T_6 – 90 kg N (urea + DAP) + 20 kg N (karanj oil cake) + 10 kg N (FYM)	24.0 (29.3)	12.7 (20.8)	18.4 (25.1)	18.7 (25.5)	17.3 (24.5)	18.0 (25.0)	14.3 (22.2)	9.0 (17.3)	11.7 (19.8)
T_7 – 100 kg N (urea + DAP) + 20 kg N (FYM)	20.2 (26.7)	13.7 (21.7)	17.0 (24.2)	21.0 (27.2)	18.3 (25.2)	19.7 (26.2)	15.7 (23.2)	9.3 (17.5)	12.5 (20.4)
T_8 – 12 kg N (urea + DAP) (control)	16.3 (23.8)	10.3 (18.4)	13.3 (21.1)	22.4 (28.2)	15.3 (23.0)	18.9 (25.6)	22.4 (28.2)	22.3 (28.0)	22.4 (28.1)
SE (±)	1.50	1.67	1.59	1.52	1.92	1.72	0.95	2.01	1.48
CD at 5%	4.56	4.90	4.80	4.61	5.84	5.21	2.87	6.1	4.48
CV%	9.8	14.7	12.3	11.4	15.0	13.4	8.0	22.1	16.01

Table 3. Influence of N-applied through integrated organic and inorganic sources on yield attributing characters of hybrid rice. Mean of three replications. Figures in parentheses are transformed arc sine values.

Treatments	No. of tillers/m^2			Plant height (cm)		
	2005-06	2006-07	Mean	2005-06	2006-07	Mean
T_1– 60 kg N (urea + DAP) + 60 kg N (FYM)	513.3	536.3	524.8	122.7	132.8	127.8
T_2 – 90 kg N (urea + DAP) + 30 kg N (neem oil cake)	531.3	539.0	535.2	133	122.5	127.8
T_3 – 90 kg N (urea + DAP) + 30 kg N (karanj oil cake)	504.0	524.0	514.0	119.2	121.5	120.4
T_4 – 90 kg N (urea + DAP) + 15 kg N (neem oil cake) + 15 kg N (karanj oil cake)	528.7	541.3	535.0	128.3	122.9	125.6
T_5 – 90 kg N (urea + DAP) + 20 kg N (neem oil cake) + 10 kg N (FYM)	538.3	546.7	542.5	135.4	128.9	132.2
T_6 – 90 kg N (urea + DAP) + 20 kg N (karanj oil cake) + 10 kg N (FYM)	510.0	522.6	516.3	121.2	125.6	123.4
T_7 – 100 kg N (urea + DAP) + 20 kg N (FYM)	528.0	534.3	531.2	125.9	123.5	124.7
T_8 – 120 kg N (urea + DAP) (control)	492.7	517.3	505.0	129.7	125.4	127.6

Table 3. Continued.

Treatments	Panicle length (cm)			No. of grains per panicle		
	2005-06	2006-07	Mean	2005-06	2006-07	Mean
T_1 – 60 kg N (urea + DAP) + 60 kg N (FYM)	30.1	29.3	29.7	305.4	292.5	299.0
T_2 – 90 kg N (urea + DAP) + 30 kg N (neem oil cake)	31.2	30.5	30.9	309.2	289.3	299.2
T_3 – 90 kg N (urea + DAP) + 30 kg N (karanj oil cake)	28.8	31.5	30.2	276.2	285.2	280.7
T_4 – 90 kg N (urea + DAP) + 15 kg N (neem oil cake) + 15 kg N (karanj oil cake)	31.1	27.0	30.1	298.4	291.4	294.9
T_5 – 90 kg N (urea + DAP) + 20 kg N (neem oil cake) + 10 kg N (FYM)	32.8	30.3	31.6	326.3	320.1	326.2
T_6 – 90 kg N (urea + DAP) + 20 kg N (karanj oil cake) + 10 kg N (FYM)	28.9	26.4	27.2	291.1	286.3	288.7
T_7 – 100 kg N (urea + DAP) + 20 kg N (FYM)	28.5	31.7	30.1	288.3	299.2	293.8
T_8 – 120 kg N (urea + DAP) (control)	31.4	28.4	29.9	283.4	279.4	281.4

recorded for each plot after threshing and sun drying for seven days as recommended.

Results and Discussion

As may be observed from the pooled data of 2005-06 and 2006-07 crop season, the least false smut disease with number of affected florets of 6.3 per panicle, panicle affected per cent of 8.2 and disease severity of 44.4%. The treatment recorded 14.5% of leaf blast, 9.8% of neck blast and 15.2% of brown spot in plots in which 90 kg nitrogen was applied in inorganic form (urea plus DAP) plus 20 kg nitrogen (neem cake) plus 10 kg nitrogen (FYM) in organic forms (Tables 1 and 2). These treatments also recorded mean maximum number of tillers/m^2 (542.5), plant height (132.2), panicle length (31.6), number of grains per panicle (326.2), highest grain and straw yields of 81.7 q/ha and 156.8 q/ha, respectively. The treatment recorded 22.1% more grain yield over control. This treatment was followed by 90 kg nitrogen applied in inorganic form (urea plus DAP) plus 30 kg nitrogen in the form of neem cake which recorded mean grain and straw yields of 80.3 q/ha and 147.7 q/ha, respectively. This treatment also recorded 20.2% increase in yield over control (Tables 2 and 3).

Continuous cropping leads to depletion of soil organic matter due to increased oxidation and rapid turn over of added organic materials. Adequate fertilization and returning the crop residues to the soil is likely to maintain the soil organic matter at a satisfactory level. Soil amendments encourage growth and multiplication of micro-flora and reduces onslaught of pathogens either by competition or antibiosis (5, 9).

Table 4. Influence of N-applied through integrated organic and inorganic sources on yields of hybrid rice. Mean of three replications.

Treatments	Grain yield (q/ha)			Increase in yield over control (%)			Straw yield (q/ha)		
	2005-06	2006-07	Mean	2005-06	2006-07	Mean	2005-06	2006-07	Mean
T_1–60 kg N (urea + DAP) + 60 kg N (FYM)	76.0	74.3	75.2	16.0	8.8	12.4	145.2	142.3	143.8
T_2 – 90 kg N (urea + DAP) + 30 kg N (neem oil cake)	80.5	80.0	80.3	22.9	17.1	20.0	151.1	147.7	149.4
T_3 – 90 kg N (urea + DAP) + 30 kg N (karanj oil cake)	76.3	78.7	77.5	16.5	15.2	15.9	134.5	150.3	142.4
T_4 – 90 kg N (urea + DAP) + 15 kg N (neem oil cake) + 15 kg N (karanj oil cake)	79.3	72.3	75.8	21.1	5.9	13.5	143.3	135.0	139.2
T_5 – 90 kg N (urea + DAP) + 20 kg N (neem oil cake) + 10 kg N (FYM)	81.0	82.3	81.7	23.7	20.5	22.1	156.0	157.7	156.8
T_6 – 90 kg N (urea + DAP) + 20 kg N (karanj oil cake) + 10 kg N (FYM)	73.5	75.5	74.5	12.2	10.2	11.2	132.7	151.0	141.9
T_7 – 100 kg N (urea + DAP) + 20 kg N (FYM)	78.0	76.7	77.4	19.1	12.3	15.7	135.2	150.0	142.6
T_8 – 120 kg N (urea + DAP) (control)	65.5	68.3	66.9	–	–	–	128.5	128.0	128.3
SE (±)	3.65	3.17	3.41				5.62	5.32	5.47
CD at 5%	11.06	9.61	10.33				17.05	16.15	16.57
CV%	8.71	7.61	8.63				7.21	6.68	7.01

References

1. Appa Rao. A. 1964. Nitrogenous manuring in relation to blast disease of rice. Proc. Indian Acad. Sci. 49B : 173—184.
2. Basu A. and P. K. Sengupta. 1996. Effect of different forms of N-fertilizers on sheath blight of rice. Indian Phytopath. 49 : 87—88.
3. Khan A. A. and A. P. Sinha. 2005. Influence of soil and nutritional factors on the effectivity of *Trichoderma harzianum* against sheath blight of rice. Indian Phytopath. 58 : 276—281.
4. Meena B. and M. Muthuswamy. 1999. Effect of organic soil amendments against rice sheath blight. Indian Phytopath. 52 : 92—93.
5. Vijaya M. and K. A. Balasubramanian. 2002. Influence of nitrogen through integrated sources of organic and inorganic on rice blast disease. J. Mycol. and Pl. Pathol. 32 : 211—212.
6. Barnwal M. K., B. K. Agarwal and S. M. Prasad. 2007. Effect of different levels of nitrogen and karanj cake in relation to occurrence of diseases and yield of rice. J. Pl. Prot. Environ. 4 : 122—125.
7. Anonymous. 1996. Standard evaluation system of rice. Int. Rice Res. Inst. (IRRI), Philippines.
8. Singh R. A. and K. S. Dubey. 1978. Assessment of loss in seven rice cultivars due to false smut. Indian Phytopath. 31 : 186—188.
9. Singh A. 1972. Maintaining soil organic matter in multiple cropping. Indian Fmg. 22 : 125—129.