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Management of brown spot disease in rice (*Helminthosporium oryzae*) by spraying of cow urine

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Abstract
Rice (*Oryza sativa*) is one of the most important food grain crops and used as second most important cereal crop in the world after wheat crop. The majority of the rice-wheat areas are in the Indo-Gangetic plain which run from the North to East across the northern India. Among the different diseases of rice, Brown spot disease is also an important calprit for low yield of the crop. This field experiment was performed at *Kharif* during the year of 2015-16 at Agri Farm, IAS, BHU, Varanasi to assess the effect of cow urine spray on the suppression of Brown spot of rice. The experiment was conducted with three replication under the split plot design where Fertility levels (60% RDF, 80% RDF and 100% RDF) were kept under main plots and Cow urine spray (Control, 50%, 75% and 100% concentrations) were kept under subplots. The recommended dose of fertilizer (RDF) was 120-60-60-25 Kg N-P_2O_5-K_2O-$ZnSO_4$ ha^{-1}. The varying fertility levels were unable to show the suppression of the brown spot disease whereas the varying concentrations of cow urine spray showed positive impact on that disease suppression. The 100% cow urine spray was able to minimize the brown spot score where as the control treatment exhibited maximum disease score. So, Cow urine as a bio-fungicide is able to reduce Brown spot infestation.

Keywords: Rice, bio-fungicide, brown spot disease, disease score, recommended dose of fertilizer, fertility level, cow urine concentration, cow urine spray

Introduction
Rice is an important food grain crop and plays a critical role in food security particularly in South Asia and especially in India. Globally, total rice consumption is about 491.5 million metric tonnes in 2014-15 (Anonymous, 2016) [1]. There are several diseases observed in rice crop. Among them, Blast and Brown spot disease are the most devastating occurring together as a complex. In the Year of 1943, Bengal famine was happened due to Brown spot disease.
Use of Cow urine as a bio-fungicide instead of fungicide (e.g, Nativo 75 WG) is an alternative was to manage brown spot disease which is cost effective, can reduce environmental pollution and enhance the safety of agricultural produce and maintain agricultural sustainability. Pest repellent prepared from cow urine and neem leaves exhibits excellent insecticidal, fungicidal and pesticidal properties and also exerts excellent plant growth promotion property (Dhama *et al*., 2005) [2]. Cow urine contains physiologically active substances viz., growth regulators, nutrients reported that diluted cow urine applied on broad leaf mustard significantly reduces powdery mildew. Nautiyal and coworkers [10] reported controlling of plant pathogenic fungi like *Colletotrichum capsici, Sclerotium rolfsii, Alternaria alternata, Penicillium species, Rhizoctonia solani, Phytophthora palmivora, Helminthosporium* using cow dung and urine.
The spray of cow urine provided protection against brown spot of rice and it reduced the disease score and act as a good fungicide. According to Dharma *et al*, pest repellent prepared from cow urine and neem leaves exhibits excellent insecticidal, fungicidal and pesticidal properties and also exerts excellent plant growth promotion property. Jandaik *et al* (2015) [5] observed that antifungal activity of three different concentrations (5, 10, and 15%) of cow urine against three fungal pathogens (*Fusarium oxysporum, Rhizoctonia solani*, and *Sclerotium rolfsii*) isolated from infected plants of Methi and Bhindi. Foliar spray of cow urine has disease suppressive property and also it creates induced systemic resistance of the rice plant

The main objective of the present investigation was to evaluate the effect of cow urine spray in fertility levels on the suppression of brown spot disease of rice caused by *Helminthosporium oryzae*.

A field experiment was conducted in rice in the Department of Agronomy, Institute of Agricultural Sciences, B.H.U., Varanasi, India during *kharif* season of 2015-16 in the Split plot design to investigate the effect of Cow urine spray under different fertility level on the on the suppression of brown spot disease of rice (Var-BPT-5204) caused by *Helminthosporium oryzae*. The main plot treatments consisted three fertility levels, F_1= 60% RDF, F_2= 80% RDF & F_3= 100% RDF and the Sub plot treatments were four foliar spray of cow urine at different concentration, U_0= control (0 l. Urine + 600 l. Water ha^{-1}), U_1= 50% (300 l. Urine + 300 l. Water ha^{-1}), U_2= 75% (450 l. Urine + 150 l. Water ha^{-1}), U_3= 100% (600 l. Urine + 0 l. Water ha^{-1}) where RDF = 120-60-60-25 kg N, P_2O_5,K_2O and $ZnSO_4$ ha^{-1}. The cow urine was collected from the IFS model, BHU, Varanasi. The cow urine used in this research was seven days old before the start of the experiment in the research plot. The nutrient content of the initially taken cow urine sample were 0.978% N, 1.15% K, 0.093% P, 0.013% Ca, 0.14% Mg, 0.083% S. Surfectant was also used during cow urine spraying to reduce spray drift. Cow urine spray to rice was started from 30 DAT and it was continued four times upto 90 DAT in twenty days interval.

The disease scoring was done on 21st October, 2015. The evaluations of disease score were done in thirty six plots based on the rating scale (SES, 1996) given below. Firstly, the four tagged hills in each plot after the 70 DAT and the scoring of four tagged hill were done based on the assumptions with the help of following scale rating given below.

Score	Infection (Infected leaf area in %)	Host behaviour
0	No incidence	Immune
1	Less than 1 %	Highly resistant
2	1-3 %	Resistant
3	4-5%	Moderately resistant
4	6-10%	Moderately resistant
5	11-15 %	Moderately susceptible
6	16-25 %	Moderately susceptible
7	26-50 %	Susceptible
8	51-75%	Highly susceptible

However, Grain protein content (%) and protein yield (ka ha^{-1}) were estimated by estimating the nitrogen content in grain with the help of Micro Kjeldahl method (Jackson, 1973) [4]. Then, by multiplying the nitrogen content (%) in grain with the factor 6.25, the protein content (%) in grain was calculated. Similarly, by multiplying the protein content (%) with the corresponding treatment yields, the protein yields were estimated.

Table 1: Effect of Fertility Levels and Cow urine spray on the Brown spot disease score, protein content (%) and protein yield

Treatment	Brown Spot Score	Protein Content (%)	Protein Yield (kg/ha)
Fertility Levels			
60% RDF	3.5	8.59^{a}	405.62^{a}
80% RDF	3.7	8.78^{ab}	442.95^{ab}
100% RDF	3.7	9.1^{b}	498.68^{b}
SEm±	0.19	0.13	19.4
CD(0.05)	**NS**	**0.39**	**56.6**
Cow Urine spray			
Control	5.4^{d}	8.7	414.12^{a}
50% CU	3.8^{bc}	8.83	446.79^{b}
75% CU	3.1^{b}	8.89	454.28^{bc}
100% CU	2.3^{a}	8.97	484.38^{d}
SEm±	0.25	0.07	9.9
CD(0.05)	0.75	NS	28.9

The data pertaining to all the observations were subjected to ANOVA using Microsoft office excel-2007. The data were analysed as per the procedure of split plot design. Screening of the brown spot disease score clearly revealed that there was no marked influence of fertility levels on the brown spot disease score as the values did not differ statistically at different fertility level. Disease score data further revealed that decreasing cow urine concentration from 100% CU to control as foliar spray markedly increased the disease score. Notwithstanding, cow urine foliar spray showed significant influence on disease score reduction as compared to lower concentrations. 100% CU exhibited 57.4% reduction of disease score over control. However, 50% and 75% concentration of cow urine spray did not touch the level of significance.

It is evident from the protein content and protein yield data that decreasing fertility levels from 100% to 60% RDF significantly reduced grain protein content (%) of rice. However, the difference was only found between highest and lowest fertility levels. With respect to the cow urine spray, increment of cow urine concentration increased grain protein content but the differences failed to touch the level of significance.

Fig 1: Infestation of Brown spot disease in the experimental plot in BHU, Varanasi.

It is also apparent from the data that increment in fertility level increased grain protein yield recording maximum at highest fertility level. However, the difference in protein yield was significant only between 100% and 60% RDF. With respect to the cow urine spray, it is clear that protein yield of rice significantly improved with increasing the concentration of cow urine from control to 100% as foliar spray. Nevertheless, 50% and 75% CU concentration did not differ markedly among themselves.

Murugan *et al.* (2012) [7] conducted an experiment at Ramji Nagar, Trichyto study on cow urine and *Pongamiapinnata* seed in farmyard. They observed that cow urine was a natural, cost effective and ecofriendly remedy to bacterial leaf blight disease control. Similarly at Khulna University, Bangladesh concluded to evaluate the effect of different plants extracts and namely rhizome of turmeric, rhizome ginger, neem leaf, tobacco leaf, tobacco leaf extract in water, tobacco leaf extract in cow's urine, and cow's urine at different concentrations (70%, 60%, 50%, 40% and 30%) on the growth and sclerotia formation of *Sclerotium rolfsii*, causal agent of foot and root rot disease of betelvine. The growth inhibition of sclerotia was found to increase with increase in concentration of cow urine extract.

However, Sahare (2015) [9] conducted an experiment at UAS, Dharwad, Karnataka to study the effect of cow urine on the quality of aerobic rice. He concluded that the milling percent, protein content, and starch content were considerably increased by cow urine foliar spray @ 10% at panicle emergence and flowering stages.

Finally, it was concluded that cow urine as a bio fungicide and growth regulator is a gold to the poor farming communities and it is a key from waste to wealth innovation.

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