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Effect of application of borogold (Combination of nano silver particles peroxy acid) on management of sheath blight of Rice

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Abstract
Sheath blight disease in rice has caused major crop losses in worldwide. Managing the causal agent of disease *Rhizoctonia solani* Kühn is difficult because of its broad range and formation of sclerotia which can survive in harsh environmental condition; therefore developing innovative disease management methods without application of hazardous chemicals has been considered as the main concern to maintain sustainable agriculture. The present research revealed to control sheath blight disease of rice by application of Borogold (SNSp). The tested silver nanoparticles Borogold *i.e.,* T3 (Root dipping or three spray of borogold), treatment found highly effective in reducing the disease severity of sheath blight, 17.77% and 62.94% decrease of the disease over control treatment was at par with T1 (Root dipping or two spray of borogold), 18.51% reducing the disease severity and 60.94% decrease disease over control and 59.07% decrease the disease over control treatment followed by T6 (No root dipping or two spray or borogold, whereas the maximum disease severity 47.40% was recorded under T7 (control).

Keywords: Rice, *Rhizoctonia solani*, Chemical control, *In vivo*, Borogold (SNSp).

Introduction
Sheath blight is the most important disease of rice incited by *Rhizoctonia solani* Kuhn first reported by Paracer and Chahal (1963) from Gurdaspur in Punjab state. The initial symptoms usually develop as lesions on sheaths of lower leaves near the waterline when plants are in the late tillering or nearly internode elongation growth stage. These lesions usually develop just below the leaf collar as oval to elliptical, green grey, water - soaked spots about ¼ inch wide and ½to¼ inch long. With age, the lesions expand and the centre of the lesions may become bleached with an irregular brown border. When humidity exceeds 95% and temperature ranges from 29 to 32 ^{O}C, infection spreads rapidly by means of runner hyphae which appear on plant parts, including leaf blades, causing irregularly shaped lesions with brown borders as bands. This symptom generally referred as "banded blight".

The Chhattisgarh state is popularly known as "rice bowl" of the country as rice is the principal crop of this state and about 70 per cent of net sown area is covered under rice. The productivity of rice in Chhattisgarh is comparatively lower than the national average. Rice is attacked by number of fungal, bacterial, viral and nematode diseases. Among all pathogenic organisms, fungal pathogens are limiting the rice productivity to great extent. Serious incidences of diseases such as blast, sheath blight or bacterial blight have been reported from rice growing areas of Chhattisgarh region.

The fungus *Rhizoctonia solani* produced usually long cells of septate mycelium which are hyline within young, yellowish brown. It produced large number of globose sclerotia which initially turn white, late turn brown to purplish brown. Sclerotia serve as a major source of primary inoculums. Wide host range of the pathogen *Rhizoctonia solani* makes management of the disease a different tast. Breeding for resistance through effective has not succeeded dur to lack of suitable clones. Fungicide application is the most common approach among the farmers for the management of sheath blight throughout the world. These agents are hazardous and may persist and accumulate in natural ecosystems an answer to this problem is replacing chemicals with biological approaches, which are considered more environment friendly in the long term Chien, C.C. and Chu, C.L. (1973).

Methods and Materials
The effect of borogold on sheath blight of rice.
To test the effect of Borogold on the twenty one day old seedlings of the cv "Swarna" were transplanted in a net plot size of 3m x 1.60 m2 with a spacing of 1m between replication to

replication. Row to row and plant to plant spacing was 20×15 cm. The experiment was laid in Randomized Block Design (RBD) with three replications. Fertilizer was applied @N120 P50 K0/ha. Fifty percent of N and total P were given as basal dose and remaining N applied in two split doses as top dressing at tillering and panicle initiation stage. There were seven treatments (Table1).

Table 1: Application of borogold (combination of nano silver particles peroxy acid) on management of sheath blight of rice

Treatments	Sprays	Quantity
T1	Root dipping-Dipping of rice seedlings for 24 hours in Borogold solution (1.5gm in 1 lit water) + two spray of Borogold- first spray at 30 DAT + second spray at 60 DAT	2gm/lit
T2	Root dipping as per T1 + need based spray of Borogola- one spray at panical initiation (90DAT) + need based spray (one or two spray before or after PI stage)	2gm/lit
T3	Root dipping as per T1 + three spray of Borogold first spray at 30 DAT + second spray at panicle initiation (90 DAT) + third spray at 50% flowering (110 DAT)	2gm/lit
T4	No root dipping- Two spray of Borogold- first spray at 30 DAT + second spray at 60 DAT	2gm/lit
T5	No root dipping- Need based spray of Borogola- one spray at panical initiation (90DAT) + need based spray (one or two spray before or after PI stage)	2gm/lit
T6	No root dipping-Three spray of Borogold first spray at 30 DAT + second spray at panicle initiation (90 DAT) + third spray at 50% flowering (110 DAT)	2gm/lit
T7	Control- No spray	Untreated

In the field inoculation, sclerotia from 7-9 days old culture and rice stem bits (*Rhizoctonia solani* mycelium profusely grown) were used for inoculation of the rice plants at the maximum tillering stage. The primary tillers of each hill were tagged and inoculated gently by punching and pushing single sclerotium or rice stem bit into the sheath just 1 ½ to 2 ½ cm above the water surface level as per the position of the sheath.After 6 days of inoculation the first spray was given to each treatment, on 10th day after first spray second spray was repeated. Disease severity of sheath blight was recorded at 21 days of inoculation of the disease, crop in 0-9 scales by following the procedure of Standard Evaluation System of International Rice Testing Programme (IRRI, 2014). The numerical values were further used for the calculation of PDI (Per cent disease index) using the formula: -

The disease development would be recorded in each variety and Percent Disease severity and Per cent Disease Index will be calculated as:

$$\text{Disease severity} = \frac{\text{Total lesion length}}{\text{Total length of sheath}} \text{x} 100$$

$$\text{Per cent Disease Index (PDI)} = \frac{\text{Sum of all individual disease ratings}}{\text{Total no.of plants assessed x maximum rating}} \text{x} 100$$

Result and discussion

The isolated fungi were identified on the basis of following morphological characteristics. The genus *Rhizoctonia solani* belongs to Form Class Deuteromycetes that does not make vegetative spores and present as mycelium and sclerotia. Dark lesions were developed on the pseudostem (near water line). Some infected plants at the later growth stage of the plant, small dark bodies (sclerotia) developed. With the lapse of time numerous round little shining and dark brown to black color sclerotial bodies were formed on the affected sheath. Sclerotia were also noticed in the hollow internodal portion at maturity and were prominently visible when opened the infected portion. The above symptoms were in agreement with the authentic reports made by earlier workers on sheath boght of rice (Ou, 1972 and IRRI 1988). The plants inoculated at seedlings stage showed 60 percent mortality also confirms that the earlier reports made by Lal M. *et al.* (2012) [6]. *Rhizoctonia solani* produces shade of brown hypha, constriction at the point of branching and right angle branching in matured hyphae. The isolate shared typical characteristics of *R. solani* (a) branching at right angle near the distal septum of the cell in young vegetative hyphae, (b) formation of a septum in the branch near the point of origin, (c) constriction of the branch at origin, dolipore septum, (d) no clamp connection, (e) presence of moniloid cells, (f) undifferentiated sclerotia and (g) absence of rhizomorphs. Sclerotia were undifferentiated aggregations of thick-walled cells, small (1-3-mm diameter) irregular-shaped, brown to black structures (Guttierez *et al.* 1997) [5]. Similar result on isolation, purification and identification were reported by Parmeter and Whitney (1970) [8]: Adhipathi, P. *et al.* (2013) [1].

The effect of application of Borogold) on management of sheath blight of rice.

An experiment was laid out in the field conditions during 2017-2018 at experimental field of IGKV, Raipur to control sheath blight disease of rice by application of Borogold.

Data revealed (Table no.2 and fig.2) that at 25 days, that Borogold sprays significantly reduced sheath blight severity over control. The tested Borogold*i.e.,*T3 (Root dipping-Dipping of rice seedlings for 24 hours in Borogold solution (1.5gm in 1 lit water) + three spray of Borogold first spray at 30 DAT + second spray at panicle initiation (90 DAT) + third spray at 50% flowering (110 DAT) 2g Borogold / lit of water in each spray 500 lit water/ ha.),treatment found highly effective in reducing the disease severity of sheath blight, 17.77% and 62.94% decrease of the disease over control treatment was at par with T1 (Root dipping + two spray of borogold) 18.51% reducing the disease severity and 60.94 decrease disease over control, T2 (Root dipping + two spray of borogold + need based spray of borogold), 19.25% reducing the disease severity and 59.07% decrease the disease over control treatment followed by T6 (No root dipping or two spray or borogold), 34.06% reducing the disease severity and 28.14% decrease the disease over control.T5 (No root dipping or two spray of borogold + need based spray of borogold), 35.55% reducing the disease severity and 25.00% decrease the disease over control, whereas the maximum disease severity 47.40% was recorded under T7(control).

Min J.S, *et al.* (2009): Bhuvaneswari, V. and Raju S. K. (2012) [2]: Dutta *et al.* (2017) [4] are tested against different plant pathogen like, *Rhizoctoniasolani*, *Sclerotiarolfsi*, *Fuzarium* spp. And *Colletotrichum capsici*, found silver nanoparticle at 100 ppm have higher antifungal efficacy as compared to the recommended chemical.

Artificial Inoculation

Symptoms of *R. Solani* & Observation

Fig 1: Aapplication of Borogold (combination of Nano Particles Peroxy Acid) on management of sheath blight of rice

Table 2: The effect of application of Borogold (combination of Nano Silver Particles Peroxy Acid) on management of sheath blight of rice

Treatments	Treatment details	Mean PDI (%)	% disease reduction over control
T1	Root dipping- Dipping of rice seedlings for 24 hours in Borogold solution (1.5gm in 1 lit water) + two spray of Borogold- first spray at 30 DAT + second spray at 60 DAT	18.51 (25.41)	60.94
T2	Root dipping as per T1 + need based spray of Borogola- one spray at panical initiation (90DAT) + need based spray (one spray before PI stage)	19.25 (26.00)	59.07
T3	Rootdipping as per T1 + three spray of Borogold first spray at 30 DAT + second spray at panicle initiation (90 DAT) + third spray at 50% flowering (110 DAT)	17.77 (24.89)	62.94
T4	No root dipping- Two spray of Borogold- first spray at 30 DAT + second spray at 60 DAT	34.06 (35.67)	28.14
T5	No root dipping- Need based spray of Borogola- one spray at panical initiation (90DAT) + need based spray (one spray before PI stage)	35.55 (36.58)	25.00
T6	No root dipping-Three spray of Borogold first spray at 30 DAT + second spray at panicle initiation (90 DAT) + third spray at 50% flowering (110 DAT)	34.06 (35.68)	28.14
T7	No root dipping- no spray	47.40 (43.49)	
	SE (m)±	0.933	
	C.D (5%)	2.908	

*figures in the parenthesis are arcsin transformed values

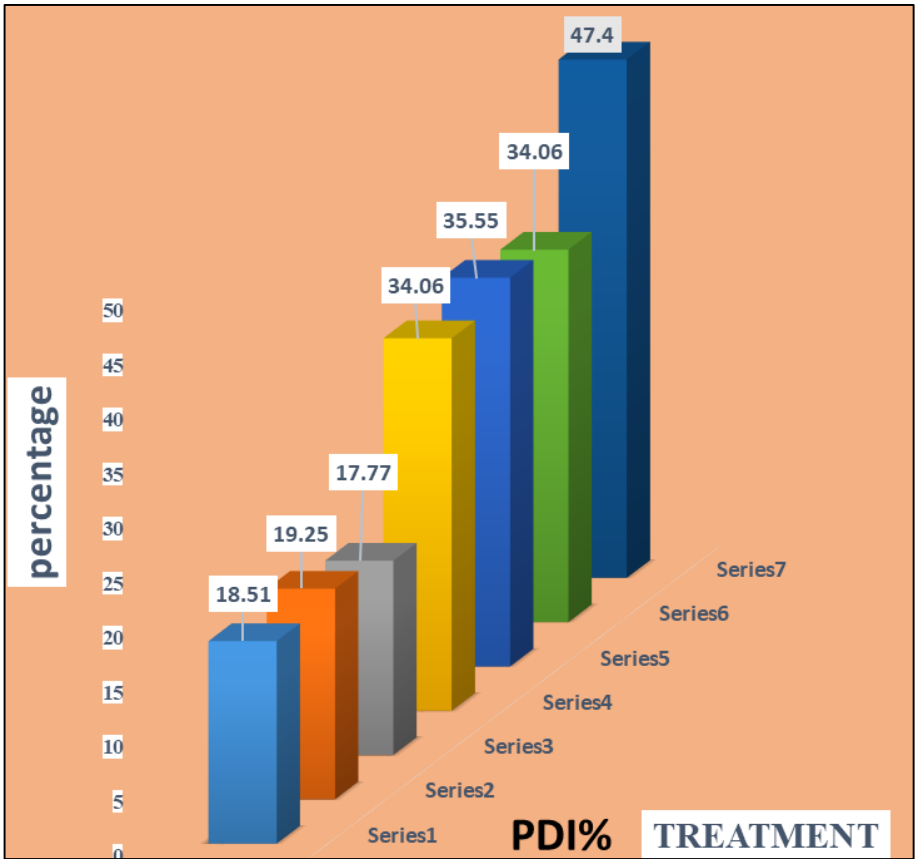

Fig 2: The effect of application of Borogold (combination of Nano silver Particles Peroxy Acid) on management of sheath blight of rice.

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