

# Effect of Spraying Potassium Silicate at Different Crop Growth Stages on Brown Spot Incidence and Grain Yield of Rice

Jaiganesh, V., Kannan, C., Thamarai Selvi, M. And Sutha Raja Kumar, R.

Department of Plant Pathology, Faculty of Agriculture,

Annamalai University, Annamalai nagar – 608 002,

Cuddalore DT, Tamil Nadu

E-mail: potatojaiganesh@gmail.com

**Abstract-** A field experiment was conducted during Navarai season at Annamalai University Agricultural Experimental Farm using ADT 36 as test cultivar. The efficacy of potassium silicate (3%) was assessed by spraying it once, twice and thrice at different crop growth stages (15, 30 and 45 DAT- Days After Transplanting). The results indicated that the disease incidence was minimum in plots sprayed thrice with potassium silicate at 15, 30 and 45 DAT, followed by plots received two sprays at 15 DAT and 30 DAT which were statistically at par. The grain yield and straw yield were higher in plots sprayed thrice (15, 30 & 45 DAT) followed by plots receiving two sprays.

**Keywords-**Rice brown spot, Potassium silicate, crop growth stages, disease incidence

## 1. INTRODUCTION

Rice is a monocotyledonous annual grass belong to family Gramineae and genus *Oryza*. Currently China and India are ranked 1st and 2nd in rice production according to Foreign Service Association of United States of Department of Agriculture Statistics. Over 90 % of the world's rice is produced and consumed in the Asian region with 6 countries (China, India, Indonesia, Bangladesh, Vietnam and Japan) accounting for about 80 % of the world's production and consumption (Abdullah et al., 2015). Rice crop is widely affected by a number of diseases caused by fungi, bacteria, viruses and mycoplasma which results in considerable yield losses (Ou, 1985). Among the various fungal diseases of rice, brown spot or sesame leaf spot incited by *Helminthosporium oryzae* (Breda de Haan) Subram. and Jain (Syn: *Bipolaris oryzae* (Breda de Haan) Shoemaker) is found to occur in most rice growing areas.

Normally fungicides are primary means of controlling plant diseases. But the use of chemical fungicides is under special scrutiny for posing potential environmental threat as the indiscriminate use of chemical fungicides resulted in environmental pollution and ill-health to biotic community as a whole. Besides, a promising alternative for the control for many rice diseases, including brown spot, is the application of silicon (Si) to soils deficient in this element (Datnoff et al., 2007). In recent years, silicon (Si) is being used for the control of fungal diseases with promising results (Yanar et al., 2011) and silicon accumulation has been reported to be one of the main

factors responsible for enhanced resistance against various pathogens of rice (Junior et al., 2009). In this context balanced nutrition seems to be a promising alternative for the control of brown spot (Carvalho et al., 2010). The present paper investigates the Effect of spraying Potassium silicate (3 %) at different crop growth stages on brown spot incidence and grain yield of rice.

## 2. MATERIALS AND METHODS

2.1. Field study was conducted to test the efficacy of potassium silicate (3%) for assessing their influence on the incidence of brown spot of rice. The brown spot susceptible variety ADT 36 was used for the study. The experiments were conducted in a randomized block design with three replications for each treatment and a suitable control. Also, the fertilizer application was done following the blanket schedule of 120:38:38 of N: P: K recommended by the State Agricultural department. A plot size of 5X4 m was maintained for each treatment and the crop was raised with the spacing of 12.5 X 10 cm and all the standard agronomic practices as recommended by the State Agricultural Department were followed. The fungicide carbendazim 50 WP @ 0.1 per cent was used for comparison. The rice crop was harvested at maturity, thrashed, winnowed and cleaned plot wise, dried and the yields of grain and straw were recorded. In all the screening field trials the observations on disease incidence was assessed on a randomly selected set of

25 hills per plot at the time of maturity. Also the grain and straw yield of rice was recorded and expressed as t/ha.

A field experiment was conducted during Navarai season at Annamalai University Agricultural Experimental Farm using ADT 36 as test cultivar. The efficacy of potassium silicate (3%) (Containing 26 % SiO<sub>2</sub>, pH- 5.6) was assessed by spraying it once, twice and thrice at different crop growth stages (15, 30 and 45 DAT). The disease incidence was assessed by adopting 0-9 scale according to "Phytopathometry" by Mayee and Datar (1986) and the per cent disease incidence /index was calculated based on the formula suggested by Vidhyasekaran *et al.* (1989).

DISEASE SEVERITY	DESCRIPTION OF DISEASE INDEX
0	No lesions
1	Affected leaf area less than 1 %
3	1-10 % affected leaf area
5	11-25 % affected leaf area
7	26 -50 % affected leaf area
9	> 50 % leaf area affected

Total ratings

$$\text{Per cent Disease Index} = \frac{\text{Total number of leaves graded}}{\text{Maximum grade}} \times 100$$

#### Straw yield

After thrashing and separation of grains, the straw was dried pot wise / plot wise in sun for two days. Later, the straw weight was weighed and computed to t ha-1.

#### Grain yield

The matured crop was harvested and the grains were hand threshed, winnowed and sun dried sufficiently. The dried grains were weighed plot wise and then converted into per hectare basis and expressed as t ha-1.

#### Biological yield

The biological yield was calculated by the summation of grain and straw yield and recorded as t ha-1.

### 3. RESULTS AND DISCUSSION

The data indicated that the disease incidence was minimum (17.30 %) in plots sprayed thrice with potassium silicate (3%) at 15, 30 and 45 DAT, followed by plots received two sprays at 15 DAT and 30 DAT (17.42 %) which were statistically at par (Table 11). The grain yield and straw yield were higher in plots sprayed thrice (15, 30 & 45 DAT) followed by plots receiving two sprays. The control plot recorded 37.06 per cent of disease incidence, 4.05 t/ha of grain yield is and 5.98 t/ha of straw yield.

Several studies have demonstrated that the severity of foliar diseases of various crops including rice can be reduced through foliar or soil applications of potassium silicate (Guevel *et al.*, 2007; Buck *et al.*, 2008; Dallagnol *et al.*, 2009).

Rodrigues *et al.* (2003) stated that silicon fertilization to rice crop reduced the incidence of sheath blight. Martinati *et al.* (2008) proved that potassium silicate treated coffee plants improved the production, productivity and increased the resistance against coffee rust caused by *Hemileia vastatrix*.

Rezende *et al.* (2009) proved that root and foliar application of potassium silicate can decrease the intensity of brown spot of rice. The ability of soluble silicon (Si) to reduce the impact of plant diseases has been sufficiently described in the rice and various crops (Rodrigues *et al.*, 2003; Kim *et al.*, 2002). Liang *et al.*, (2005) suggested that disease reduction caused by foliar sprays of potassium silicate was the result of an osmotic effect on spores germinating at the leaf surface.

It has been reported that potassium fertilizer application can decrease brown spot severity on rice (Carvalho *et al.*, 2010). The brown spot disease of rice is usually associated with an imbalance of K (potassium) and N (nitrogen) in rice leaf tissue and K is able to reduce disease intensity (Baba *et al.*, 1958). The potassium content in potassium silicate could have also contributed to the enhanced disease suppression. Further, silicon, in the form of silicic acid, would act locally by inducing defense reactions in elicited cells and would also contribute to systemic resistance by enhancing the production of stress hormones (Fauteux *et al.*, 2005). Thus, the above reasons could be attributed for the efficacy of foliar sprays of potassium silicate, in reducing the brown spot incidence of rice.

**Table 1. Effect of spraying Potassium silicate (3 %) at different crop growth stages on brown spot incidence and grain yield of rice var. ADT 36 (Field experiment)**

Treatments	Stages of spraying	Disease incidence (%)	Grain yield (t/ha)	Straw yield (t/ha)	Biological Yield
T <sub>1</sub>	15 DAT	22.89	4.63	6.80	11.43
T <sub>2</sub>	30 DAT	20.48	4.84	7.05	11.89
T <sub>3</sub>	45 DAT	23.42	4.50	6.67	11.17
T <sub>4</sub>	T <sub>1</sub> + T <sub>2</sub>	17.42	5.07	7.15	12.22
T <sub>5</sub>	T <sub>1</sub> + T <sub>3</sub>	20.00	4.93	7.12	12.05
T <sub>6</sub>	T <sub>2</sub> + T <sub>3</sub>	19.55	4.99	7.12	12.11
T <sub>7</sub>	T <sub>1</sub> + T <sub>2</sub> + T <sub>3</sub>	17.30	5.10	7.22	12.32
T <sub>8</sub>	Carbendazim 0.1 %	13.38	4.55	6.50	11.05
T <sub>9</sub>	Control	37.06	4.05	5.98	10.03
C.D. (p=0.05)		5.32	0.18	0.14	0.09

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