

A CASE STUDY

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# Incidence of Bakanae disease of basmati rice in south-western part of Punjab and its management

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## ABSTRACT

Basmati rice is an important cash crop of India, being recognized at international level for its quality and aroma. Bakanae/foot rot disease is becoming a limiting factor in its cultivation in southwestern parts of Punjab. A survey was conducted during *Kharif* 2014 in different blocks of Sri Muktsar Sahib District of Punjab to acquaint with the factor affecting disease incidence. Disease was recorded in all the basmati growing fields and up to 10 per cent incidence was recorded on different aromatic rice cultivars. Pusa Basmati 1401 was observed more susceptible followed by Pusa Basmati 1121 and Pusa Basmati 1509. Basmati crop raised at recommended period showed lower disease incidence than early transplanted crop. Higher disease incidence was observed in fields where seed was purchased from private seed companies than seed from State Agricultural University. The recommended technology to manage this disease *i.e.* seed soaking in pesticides solution containing carbendazim 50 WP @ 0.2 per cent + Streptocycline 0.01 per cent (one g) for 12 hrs followed by seedling root dip in carbendazim 50 WP (0.2%) for 6 hrs was demonstrated at selected farmers' field during *Kharif* 2015. The results showed that seed treatment with carbendazim @ 2.0 g/kg alone (farmers' practice) was not effective. The disease incidence in demonstrated plots was less as compared to farmers' practice. The grain yield and net returns were also higher in demonstrated plots.

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## INTRODUCTION

Basmati rice is an important cereal crop and India is the major producer and exporter of basmati rice to the world (Jain *et al.*, 2014). Among the various biotic factors affecting rice production and productivity, rice diseases caused by fungus, bacteria and nematodes are the most

significant constraints responsible for low yield of this crop in India (Ling, 1980 and Kumar *et al.*, 2013). The annual losses due to rice diseases are estimated to be 10-15 per cent on an average basis worldwide (Kumar *et al.*, 2013). In Punjab, foot rot (Bakanae) disease has become an economically important disease in Basmati

rice (Bagga and Kumar, 2000; Pannu *et al.*, 2012). Foot rot incidence has been increasing over the years and yield losses ranging from 15-25 per cent have been reported from Eastern U.P., Haryana and Punjab (Rathaiah *et al.*, 1991, Sunder *et al.*, 1998 and Pannu *et al.*, 2012).

Bakanae was first noted in 1928 by Ito and Kimura in Japan. It has been reported in many rice growing countries like Australia, Bangladesh, China, Korea, India and Thailand (Ou, 1985). Bakanae is a Japanese word which means bad or naughty seedling refers to the abnormal elongation, foolish seedling and stupid rice crop (Sun and Snyder, 1981). The disease is caused by one or more *Fusarium* species and complex of disease symptoms including seedling blight, excessive elongation of infected plants, foot rot, seedlings rot, grain sterility and grain discoloration with ultimate effect on grain yield and seed quality have been recorded from different regions of the world (Sun and Snyder, 1981). The pathogen is soil-borne (Nishio *et al.*, 1980) as well as seed-borne (Saponara *et al.*, 1986). It perpetuates from season to season on host crop debris buried in soil or infected seed. Infected seeds initiate the disease in fields previously free from the pathogen. It is difficult to develop bakanae resistant rice varieties due to the high genetic variation of the causal pathogens (Seráfica and Cruz, 2009). Seed treatment with fungicide has been used for management of Bakanae disease (Suzuki *et al.*, 1985 and Gupta *et al.*, 2014). However, the disease incidence threat is on increasing trend since no proper control measures were adopted. In Punjab foot rot of rice gained economic importance due to large scale cultivation of susceptible fine variety Pusa Basmati 1121. Keeping in view the importance of this disease, a study was conducted in Sri Muktsar Sahib district of Punjab to know the incidence of foot rot in different cultivars of aromatic basmati rice and effectiveness of different management practices under field conditions.

## MATERIAL AND METHODS

A survey was conducted in four blocks of Sri Muktsar Sahib district of Punjab (lie between 30° 69' and 29° 87' latitude and 74° 21' and 74° 86' longitude 184 m above mean sea level) during 2014 and 2015 in rice growing season to monitor the occurrence and incidence of the foot rot disease. Fifteen farmers from each block were contacted to collect and basic

information regarding seed source, seed treatment, cultivar, date of transplanting were collected. In each field, an overall view of the basmati rice crop was obtained and made observations for the presence or absence of disease symptoms. The disease incidence was recorded from plots of 10 m<sup>2</sup> area selected in every sampling area. Disease symptoms were observed in surveyed places at different growth stages of basmati rice. Disease incidence in term of percentage of infected hills for each plot was calculated by the following formula (Hossain *et al.*, 2011).

Disease Incidence (DI) =  $\frac{\text{Infected hills per plot}}{\text{Total hills per plot}} \times 100$

As the disease is primarily seed borne (Webster and Gunnell, 1992), seed dressing represents the first way to control the spread of the disease. However, seed treatment alone fail to prevent soil-borne infection after transplanting and control foot-rot (Bagga and Sharma, 2006). Punjab Agricultural University, Ludhiana recommended that before sowing, basmati seed should be soaked in pesticides solution containing carbendazim 50 WP @ 0.2 per cent + Streptocycline 0.01 per cent (one g) for 12 hrs followed by seedling root dip in carbendazim 50 WP (0.2%) for 6 hrs. before transplanting (Anonymous, 2014). However, the disease incidence is increasing, since no proper control measures were adopted by the farmers. Seed treatment followed by nursery treatment need to be promoted for clean cultivation of aromatic basmati rice. Method demonstration is an effective tool to expand the technologies to the farmers. In this regard, forty farmers were selected and carbendazim 50 WP + Streptocycline was given for one acre (0.4 ha) plots. The method of seed treatment followed by seedling root dip before transplanting was demonstrated at farmers' field. The demonstrated plots were observed for disease incidence and compared with farmers' practice of seed treatment with carbendazim 50 WP only. The grain yield of demonstrated plots was also recorded and net returns were calculated.

## RESULTS AND DISCUSSION

Foot rot disease of rice is now widely distributed in Asia and other rice growing countries of the world. If no control measures are taken, it may be a limiting factor for rice production. Punjab and Haryana are the major basmati rice producers of India and foot rot disease is

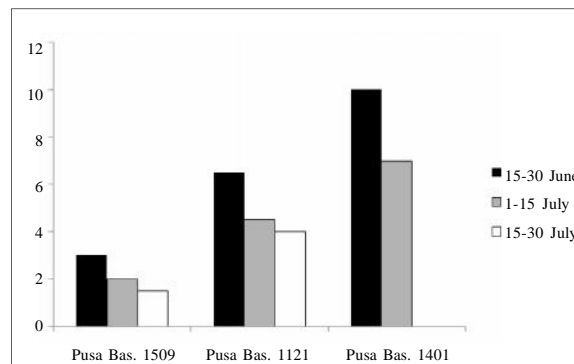
posing a serious threat to sustainable rice production. The survey of this disease in Sri Muktsar sahib district of Punjab, showed that disease was prevalent in nearly all the basmati rice growing fields. The disease incidence varied from 0.5-10 per cent in different basmati cultivars.

**Effect of cultivars on disease incidence:**

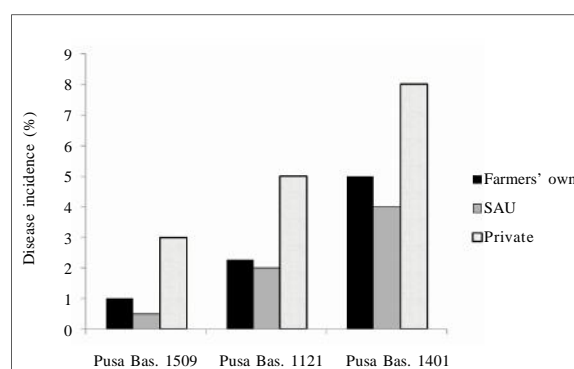
Three aromatic basmati rice cultivars viz., Pusa Basmati 1509, Pusa basmati 1121 and Pusa basmati 1401 were mainly cultivated by the farmers of the district. Out of these, Pusa basmati 1121 and Pusa Basmati 1509 were recommended by PAU, Ludhiana for cultivation in the state. The data showed that long duration variety, Pusa Basmati 1401 was more susceptible to foot rot disease and incidence varied from 4-10 per cent, whereas in case of Pusa basmati 1121 disease incidence varied from 2-6.5 per cent in surveyed plots (Fig. 1 and 2). Lower disease incidence (0.5-3.0 %) was observed in case of short duration cultivar, Pusa Basmati 1509. Bagga and Kumar (2000) also reported that recommended cultivars of basmati rice being grown in the region vary in their reaction to foot-rot.

**Effect of date of translating on disease incidence:**

Basmati rice is recommended to be transplanted in the month of July for its quality production (Anonymous, 2014). However, depending upon rainfall, canal water availability, electricity for pumping tubewell water and crop rotation, farmers have to change the transplanting dates accordingly. The differences were observed for disease incidence with different date of transplanting (Fig. 1). Overall, the disease incidence was higher in June transplanted basmati plots than those transplanted in month of July. Pusa Basmati 1401, being long duration, mainly transplanted in June month, which suffered higher disease occurrence (10 %) than late transplanted (7 %) in the month of July. Similarly, Pusa Basmati 1121



**Fig. 1 :** Effect of different date of translating on disease incidence during 2014



**Fig. 2 :** Effect of different seed source on foot rot disease incidence during 2014

transplanted during recommended period i.e. during first fortnight of July showed lower incidence than early transplanted (second fortnight of June). Pusa Basmati 1509 transplanted in the month of June also showed relatively higher incidence followed by transplanted in first fortnight of July and second fortnight of July. This variation in incidence may be due effect of different environmental factors like temperature and RH on growth of the fungus. Yadav *et al.* (2014) also reported that *Fusarium moniliforme* is an ubiquitous fungus distributed

**Table 1 : Disease incidence, grain yield and benefit cost ratio of demonstration plots in comparison to farmers' practice during 2015**

Block	Demonstration plots						Farmers' practice					
	Foot rot incidence (%)	Cost (Rs./ha)	Yield q/ha	Total returns (Rs.)	Net return (Rs.)	B:C Ratio	Foot rot incidence (%)	Cost (Rs./ha)	Yield (q/ha)	Returns (Rs.)	Net return (Rs.)	B:C ratio
Muktsar	1	24100	48	110400	86300	3.58:1	4	25300	47	108100	82800.00	3.27:1
Malout	-	22400	49	112700	90300	4.03:1	6	23800	46.5	106950	83150.00	3.49:1
Gidderbaha	1	23250	52	119600	96350	4.14:1	4.5	24250	50	115000	90750.00	3.74:1
Lambi	0.5	23500	50	115000	91500	3.89:1	5	24800	48.5	111550	86750.00	3.50:1
Mean	0.6	23312.5	49.75	114425	91112.5	3.91:1	4.87	24537.5	48	110400	85862.5	3.50:1

worldwide and environmental factors such as temperature, water activity and pH have a great influence on fungal development. However, the effect of different factors in relation to foot rot disease needs to be studied in detail.

#### **Effect of source of seed on disease incidence:**

As foot rot is seed borne disease, so quality of seed plays an important role for cultivation of disease free crop. The data collected during survey showed that farmers got seed from three different source viz., SAU (State Agricultural University) seed, seed from private company and farmers' own seed. The data showed that source of seed had influence on disease incidence (Fig. 2). Varying degree of disease incidence was observed in plots with different seed source. Higher incidence was observed in fields where seed was purchased from private seed companies than seed from SAU. Lowest disease incidence was observed in case of farmers sow their own basmati seed. The lower disease incidence in farmers seed may due to that farmers prepared limited quantity of seed from disease free plots. Krishi Vigyan Kendra also stress upon importance of disease free seed. The farmers were advised to apply one spray of propiconazole @ 0.1 per cent at boot stage on seed crop, which is very effective method to prepare disease free seed (Anonymous, 2014). So, study implies that farmer should get seed from reliable seed source and next year they should prepare their own seed.

#### **Effect of management practices on diseases incidence, grain yield and economics :**

Seed treatment followed by seedling root dip method was demonstrated in the selected farmers' field along with recommended plant protection techniques in different blocks of the district on Pusa Basmati 1121 variety. Adjacent field of the same farmer where only seed treatment was given to Pusa Basmati 1121, was considered as check plot. The data presented in Table 1 showed that seed treatment alone was not effective to control the disease and mean disease incidence in these plots were 4.8 per cent, whereas the foot rot incidence in seed treatment followed by seedling root dip method was found to be very low (0.6 %). The average grain yield in the demonstrated plots was higher (49.75 q/ha) as compared to plots in which farmers follow their own practice (48 q/ha). The income obtained

was calculated by grain yield obtained with both methods and multiplying by Rs. 2300 per quintal grain. A perusal of data revealed that there was higher average income obtained from demonstrated plots (Rs. 911125/ha) as compared to lower in farmers' method (Rs. 85862/ha). Accordingly, the benefit cost ratio was more in demonstrated method (3.91:1) than other method (3.50:1). So, seed treatment followed by seedling treatment resulted in lower disease incidence and higher net return as compared to farmers practice. These results were showed to the farmers also and they were convinced. Large scale adoption of this technology will help to reduce the menace of this disease in the area.

#### **Conclusion :**

Foot rot disease was prevalent in nearly all basmati growing fields in Sri Muksar Sahib district of Punjab. The varietal differences were observed for their resistance to this disease but none of the variety was found tolerant to this disease. Seed treatment + nursery treatment was effective method to control this disease, but this technology should be popularized among farmers, for disease free quality seed production. Realizing the potential of aromatic rice trade at international market, research on Bakanae should be emphasized.

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