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# Inoculum Build up of Bacterial Blight of Rice in Rice-Wheat Cropping Area of Punjab in Relation to Zero Tillage?

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**Abstract:** Bacterial blight (BB) of rice caused by *Xanthomonas oryzae* pv. *oryzae* is creating alarming situation in rice wheat system of Punjab in recent years. The observation recorded during surveys of rice in Punjab conducted during 1999 and 2002 showed that Super basmati is the major rice variety under cultivation in these areas. The mean incidence of disease in the month of September, 1999 was 25, 28, 15 and 29 % in Hafizabad, Sheikhupura, Gujranwala and Gujrat districts, respectively. During the recent survey in the year 2002 the mean incidence was 64, 43, 36, 34, 28, 41, 55, 45, 55 and 47 % in Sargodha, Hafizabad, Sheikhupura, Sialkot, Narowal, Gujranwala, Gujrat, Lahore, Kasur and Okara, respectively. The highest severity of BB was in the range 1-3 at Hafizabad and the lowest 0-1 in Gujranwala during 1999 and while in 2002 it was highest in the range of 0-9 in Gujranwala and lowest 0-3 in Gujrat, Lahore and Kasur, respectively. Bacterial Blight showed increasing trend with lapse of time of 3-4 years. The disease may create havoc in next couple of years as super basmati is mainly cultivated in this area and it is badly hit with this menace. Secondly as the area under zero tillage cultivation is increasing there are chances of inoculum buildup on the stubbles in the zero tillage fields. Therefore there is a need to investigate the survival mechanism of this bacterium in relation to zero tillage.

**Key words:** *Xanthomonas oryzae* pv. *oryzae*, rice, Punjab, incidence, severity

## Introduction

Rice (*Oryza sativa*) is one of the most important food crops in the world, feeding about half of humanity. It is the second major cereal crop of Pakistan after wheat. Rice is grown over two million ha and stands third in terms of area under cultivation. It is an important part of the diet of the people of Pakistan and is also a valuable source of foreign exchange earnings for the country. Rice stands second after cotton in export of agricultural commodities in Pakistan (Anonymous, 1998). It contributed around 5.7 % of the total national export annually and in 2001-2002 the value of exported rice was US$ 363.6 million (Anonymous, 2001-2002).

The rice crop is susceptible to a number of diseases among which bacterial blight of rice caused by *Xanthomonas oryzae* pv. *oryzae* (Ishiyama) Swings *et al.* (1990) is one of the most destructive disease of rice throughout the world (Mew, 1987). This disease is also a serious problem in other parts of Asia (Alim, 1967; Ou, 1985). In Pakistan the disease was recorded for the first time by Mew and Majiid (1977).

It occurs at all stages of the rice crop and shows either kresek or leaf blight symptoms. If plant produces panicles, the sterility percentage and number of immature grains increase. Grains from diseased plants were easily broken during milling. There may be 50% reduction in yield in case of severe infection, whereas under mild infection 10-12% yield reduction has been recorded (Ou, 1985). When there is heavy infection, no grain formation takes place.

*X. oryzae* pv. *oryzae* survives on rice stubbles, straw and on weed hosts. The over wintering of bacterium occurs in two forms, i.e. dry form and growth form. The pathogen in the dry form is found in the vascular vessels and xylem parenchyma of dried diseased plants and in ooze which exudes from diseased leaves and rapidly dries in summer. These dry form bacteria gradually die if they are moistened by rain in winter. Bacterial cells in the growth form are found in stubble and in the root system of perennial wild plants, especially *Leersia* spp. The pathogens surviving in an inactive state or dry form are activated and turn into the growth form upon receiving moisture under favourable conditions. The stubbles are the primary source of inoculum of bacterial blight survival. In Pakistan the area under zero tillage is increasing, which may merge the chance to flare this menace in epidemic form. Investigations to understand its survival mechanism under zero tillage are essential. The present study determines bacterial blight incidence and severity during

1999 and 2002 in rice –wheat cropping system of Punjab.

## Materials and Methods

Rice growing areas of Punjab were surveyed and rice fields near to roadside were preferred for study. The number of locations/fields surveyed depend on cropping intensity and pattern. Each halt was after 10 km on the route.

**Field based disease assessment:** The general appearance of the field was noted for the presence or absence of disease symptoms and the incidence of BB was recorded.

**Sampling points:** For each field, samples were taken at 5 points/hills along a diagonal transect. Where at each point 4 plants were examined for disease symptoms. Data of incidence and severity were collected. For scoring of BB following scale was used (Anonymous, 1996).

**For field test**

| Score | Lesions area (%) |
|---|---|
| 0 | 0 |
| 1 | 1-5 |
| 3 | 6-12 |
| 5 | 13-25 |
| 7 | 26-50 |
| 9 | 51-100 |

**Sample collection:** For collection of samples upper 3 leaves of each tiller/ plant were collected. These were composite and a representative samples were taken for isolation.

## Results and Discussion

The first survey conducted in month of September, 1999 showed the mean bacterial blight incidence was 25, 28, 15 and 29 % in Hafizabad, Sheikhupura, Gujranwala and Gujrat, respectively (Table 1).During the second survey in the year 2002 the mean incidence was 64, 43, 36, 34, 28, 41, 55, 45, 55 and 47 % in Sargodha, Hafizabad, Sheikhupura, Sialkot, Narowal, Gujranwala, Gujrat, Lahore, Kasur and Okara, respectively. The highest severity of BB was in the range 1-3 at Hafizabad and lowest 0-1 in Gujranwala during 1999 and while in 2002 it was highest in the range 0-9 in Gujranwala and lowest 3 in Gujrat, Lahore and Kasur, respectively, showing increasing trend within 3-4 years. The mean BB incidence % in 2002 was higher as compared to 1999 (Table 1). This may be due to continuous cultivation of susceptible cultivars and survival of inoculum on infected stubbles and weeds. The major rice cultivar was Super Basmati in rice wheat area of Punjab. Bacterial blight was not observed in Pakistan before 1976, it was reported in the rice fields of Kala Shah Kaku by Mew and Majiid (1977), later Ahmad and Majiid (1980) noticed on rice varieties IR 6, Palman, Basmiti198 at rice research institute Kala Shah Kaku and farmer's field. During rice traveling seminar in 1985 its incidence on farmers field was recorded 10-15, 15-20, 20-25% in Sindh, Punjab and NWFP, respectively (Akhtar and Sarwar, 1986). Nineteen rice cultivars under NURYT trail 1985 were tested at 10 locations. Its occurrence was noted in almost all provinces of Pakistan (Akhtar and Akram, 1987). Khan *et al.* (2000) narrated that BB incidence is increasing in Pakistan in recent years especially in Kaller belt that is famous for producing high quality rice The earlier studies showed that the bacterium can over winter on rice infected stubbles, rice straw and weeds (Ou, 1985). Infected stubbles, weed and straw can be primary inoculum source of BB, so proper management of rice stubbles and rice straw is essential otherwise we are providing more chance of increasing inoculum source on year to year basis. With the introduction of high yielding but susceptible cultivars of Basmati and zero tillage technology, continuous monitoring of BB under resource conservation technology is imperative.

Table 1: Incidence and severity of Bacterial Blight of Rice in Punjab during 1999 and 2002

| | 1999 | | | | 2002 | | | |
|---|---|---|---|---|---|---|---|---|
| | Incidence (%) | | Severity (0-9) | | Incidence (%) | | Severity (0-9) | |
| Districts | Range | Mean | Range | Mean | Range | Mean | Range | Mean |
| Sargodha | - | - | - | - | 15-100 | 64 | 1-7 | 5 |
| Hafizabad | 19-32.2 | 25 | 1-3 | 1 | 10-70 | 43 | 1-5 | 3 |
| Sheikhupura | 10.2-38.5 | 28 | 1-2 | 1 | 10-90 | 36 | 1-5 | 3 |
| Sialkot | - | - | - | - | 15-65 | 34 | 1-3 | 1 |
| Narowal | - | - | - | - | 0-50 | 28 | 0-5 | 3 |
| Gujranwala | 2.1-27.6 | 15 | 0-1 | 1 | 0-100 | 41 | 0-9 | 3 |
| Gujrat | 17.6-38.5 | 29 | 0-2 | 1 | 30-80 | 55 | 3 | 3 |
| Lahore | - | - | - | - | 45 | 45 | 3 | 3 |
| Kasur | - | - | - | - | 50-70 | 55 | 3 | 3 |
| Okara | - | - | - | - | 40-50 | 47 | 3-5 | 3 |

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