**Original Article** **Asian J Agri Biol, 2015, 3(2): 74-78.**

# ASSESSMENT OF YIELD LOSSESS CAUSED BY BACTERIAL BLIGHT OF RICE IN UPPER DIR, KHYBER PAKHTUNKHWA PROVINCE

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## ABSTRACT

The present study was conducted to assess the yield losses caused by bacterial brlight of Rice (*Xanthomonas oryzae pv oryza*) in Upper Dir a district of Khyber Pakhtunkhwa province of Pakistan during cropping season 2013-2014. Four rice growing locations of district namely Barawal Bandi, Satara, Maidan khwar and Thikar Kot were selected. In Upper Dir disease incidence (%) ranged between 57.14%-75% while disease severity (%) was between 36.04 to 66.12%. Highest disease incidence (75%) and disease severity (66.12%) was recorded from Barawal Bandi location whereas lowest disease incidence and disease severity was recorded from Thikar kot. Similarly maximum 1000 grain weight losses was also recorded in Barawal Bandi while minimum 1000 grain weight loss was recorded in Thikar kot. It can be concluded that Bacterial blight of rice was more severe in Barawal location and less severe in Thikar kot.
**Keywords:** Rice, bacterial blight, % Incidence, % Severity

## INTRODUCTION

Rice (*Oryzae sativa* L.), is an annual plant which belongs to family *Poaceae* and is mostly cultivated in tropical and subtropical regions of the world (Ezuka and Kaku, 2000). Rice is an important staple food crop of the world especially of the Asian countries such as Bangladesh, Pakistan, China, Vietnam and Korea. It ranks as the third largest crop after wheat and maize and has an integral position in the economy of Pakistan as a staple food as well as an export item (Salim et al., 2003; Zahid et al., 2005). There are several varieties of rice grown in Pakistan but basmati and kernel are the major varieties grown in rice growing areas of Pakistan (Ahmad et al., 2007). These two varieties are famous for their taste and aroma. Unfortunately, yield of rice obtained from per unit area in Pakistan is very low from neighboring countries and the world. Rice production is severely affected by various diseases such as viral, bacterial and fungal which are primarily responsible for the low yield of rice. Among the bacterial diseases of rice, bacterial leaf blight (BLB) i.e., *Xanthomonas oryzae* pv. *oryzae*, is a major bacterial disease of rice which frequently appeared in rain fed, irrigated and deep water rice growing areas (Mew, 1987). The *Xanthomonas oryzae* pv. *oryzae* is a gram negative bacterium belongs to Gracillicutes and is known to be one of the most disparaging disease of rice throughout the world and especially in South Asia (Swings et al., 1990; Ou, 1985). Leaf blight disease was first recorded in Japan and later on, its occurrence has been reported from Asian and African countries (Mew et al., 1993; Ezuka and Kaku, 2000). In Pakistan, bacterial leaf blight (BLB) occurrence was confirmed from all rice growing areas in 1977 except the Tribal belt and Dir valley (Mew and Majid, 1977). Recently its incidence has augmented in "Kaller" belt which is prominent for rice farming (Khan et al., 2000). BLB infects almost all the growth stages of rice and reveals either leaf blight "kresek" symptoms. The pathogen enters into plants through water pores and wounds. Since the water pores are located at the margins of upper surface of the leaves. Therefore, the lesion caused by bacterial leaf blight frequently emerges from the leaf margins near its tips (Mizukami, 1956; Mizukami, 1961; Tabei and Mukoo, 1960). Symptoms of this disease includes, tiny water soaked lesion, which then turn yellow as the disease progresses and finally develops into an elongated irregular lesion with wavy margins. Sign of the causal agent as bacterial ooze can be seen on the margins or veins of the freshly infected leaf under moist conditions (Tagami

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and Mizukami, 1962; Octa, 1970; Ou, 1985). If the plant is infected with the bacterial leaf blight disease, the panicles will only contain sterile immature grains, which are easily fractured during milling process. In case of severe infection, 50% reduction in yield can be expected from bacterial leaf blight disease (BLB) (Mew et al., 1993) whereas in case of mild infection 10-12% yield reduction has been recorded (Ou, 1985).

Breeding resistance varieties has become an essential objective for the management of leaf blight disease (Mew et al., 1987). Actually, no approach is considered as an effective and economic practice to control this disease (Devadath, 1989). Keeping in view the importance of bacterial leaf blight disease, this study was initiated to assess the incidence and severity of BLB and to determine yield losses caused by BLB in Upper Dir district of Khyber Pakhtunkhwa province of Pakistan.

## MATERIALS AND METHODS

The present research work was carried out in different rice growing areas of Upper Dir, located in the Khyber Pakhtunkhwa.

**Survey**: A comprehensive survey was conducted for various locations of Upper Dir during 2013-14 cropping season at the booting stage of the crop. Leaves showing typical symptoms of Bacterial Blight of rice were observed. Four different locations of upper dir including Barawal Bandi, Satara, Maidan Khwar and Thikar Kot were visited during the survey. The Data on disease incidence (%), severity (%) and 1000 grain weight loss were recorded as follows:

**Disease incidence (%):** In order to calculate disease incidence (%) five random spots of $1m^2$ area were selected in the field and the infected plants were counted and percentage of incidence was calculated from the total number of number of plants from that area.

**Disease severity (%):** Five plants in each location were randomly selected. The data regarding lesion length and total leaf area were recorded on five leaves of the selected plants and percent disease severity was worked out.

For disease rating, scale of Chaudhry (1996) was used (Table 1).

**Table 1: Disease severity scale for bacterial leaf blight disease (Chaudhry, 1996).**

| Disease Score | Lesion area (%) | Disease Reaction |
|---|---|---|
| 0 | 0 | Highly Resistant (HR) |
| 1 | 1-10 | Resistant (R) |
| 3 | 11-30 | Moderately Resistant (MR) |
| 5 | 31-50 | Moderately Susceptible (MS) |
| 7 | 51-75 | Susceptible (S) |
| 9 | 76-100 | Highly Susceptible (HS) |

**Loss in grain weight (GW)**

For calculating loss in grain weight, samples were dried and their grains were separated from both healthy and diseased plants. Loss (%) in grain weight was calculated using the following formula:

$$\% \text{ loss in 100 GW} = \frac{W_1 - W_2}{W_1} \times 100$$

Where, GW= Grain weight, $W_1$= Weight of 1000-grain obtain from healthy plants and $W_2$= Weigh of 1000-grain obtain from the disease plants.

**Statistical analysis**

Descriptive statistics was used for the analysis of obtained data i.e. disease severity and disease incidence of bacterial leaf blight disease of rice were expressed in percentages.

## RESULTS AND DISCUSSION

**Disease incidence:** Data regarding disease incidence of bacterial leaf blight (BLB) in Upper Dir during year 2011-2012 are shown in Table 2. The peak disease incidence (75%) was recorded for Barawal Banda, followed by Satara 68.18%. However, lowest (57.14%) disease incidence was recorded for Thikar Kot. This difference may be attributed due to high relative humidity in Barawal Bandi. Same experiments of bacterial blight of leaf were also conducted by Akhtar et al. (2003) who found that BLB disease of rice prompted by *Xanthomonas oryzae* pv. *oryzae* has created a serious situation in all provinces of Pakistan

viz., Punjab, Khyber pakhtukhwa, Sindh, Baluchistan including Azad Kashmir. In Punjab the Disease Incidence of BLB ranges from 16-100%, 11-71%, 11-91%, 16-65%, 1-50%, 2-100%, 32-80%, 47%, 50-71% and 40-50% in Sargodha, Hafizabad, Sheikhupura, Sialkot, Narowal, Gujranwala, Gujrat, Lahore, Kasurand and Okara district. In Sindh the Disease Incidence (%) was 0% in Larkana, 0-5% in Shikarpur, 5% in Dadu, 0% in Nawab Shah, 5% in Thatta, 0-5% in Badin, 0-5% in Jacob Abad. In Khyber Pakhtunkhwa province the disease incidence (%) range was 3-96, 2-100 and 0 in Lower Dir, Swat and Malakand Agency respectively. In Baluchistan the Disease Incidence (%) range was 0 and 1-5 in Nasirabad and Usta Muhammad respectively while in Azad Jammu and Kashmir (AJK) no disease was observed. There were no reports of bacterial blight diseases from Gilgit Baltistan. Khan et al. (2008) carried out a survey on disease incidence and losses caused by BLB disease of rice in Pakistan. It was found that 80% rice crops in some fields were affected near Manawala and almost 100% in Feroz watwan, areas of district Sheikupura. In Mureedkey and Sheikhupura, 70-80% rice fields were found to be infected with rice blight whereas in Narung and Wahndo, 90-100% rice fields were found to be infected with bacterial leaf blight disease.

**Table 2. Disease Incidence (%) for bacterial leaf blight disease recorded in four locations of Upper Dir District.**

| Location | Disease Incidence (%) |
|---|---|
| Barawal Bandi | 75 |
| Satara | 68.18 |
| Maidan Khwar | 66.66 |
| Thikar Kot | 57.14 |

**Disease severity (%):** Maximum 66.12% disease severity was recorded for Barawal Bandi location of Upper Dir Khyber Pakhtunkhwa, followed by Maidan Khwar (55.9%) and Satara (41.02%) while in Thikar Kot minimum disease severity (36.04%) was recorded (Table 3). Therefore in Barawal Bandi location rice crop was categorized as more susceptible to the BLB pathogen and this might be due to high relative humidity (>70%). These results are in accordance with previous observations of Akhtar et al. (2003) who recorded disease severity in Swat, Malakand Agency and lower Dir.

**Table 3: Disease Severity (%) of bacterial leaf blight disease recorded in four locations of Upper Dir District.**

| Location | Average severity (%) | Category |
|---|---|---|
| Barawal Bandi | 66.12 | Susceptible (S) |
| Satara | 41.02 | Moderately Susceptible (MS) |
| Maidan Khwar | 55.9 | Susceptible |
| Thikar Kot | 36.04 | Moderately Susceptible (MS) |

**1000 Grain Weight loss of five locations:** The highest loss in 1000 grain weight was 15.59% at Barawal Bandi, followed by Satara, Maidan Khwar and Thikar Kot (12.13, 13.37 and 11.94% respectively). Increase in disease severity is the main cause of the decrease in 1000 grain weight (Table 4). Thousand grain weight losses due to BLB are varied depending on location, season, crop growth stage, and cultivar (Ahmad and Singh, 1975; Mohiuddin et. al., 1977; Muralidharan and Rao, 1979; Srivastava and Kapoor, 1982).

**Table 4: Thousand Grain Weight loss due to bacterial leaf blight at four locations of Upper Dir District.**

| Locations | 1000g Grain Weight (Healthy Plants) | 1000g Grain Weight (Disease Plants) | Loss in Weight (%) |
|---|---|---|---|
| Barawal Bandi | 32.89g | 27.76g | 15.59 |
| Satara | 30.91g | 27.16g | 12.13 |
| Maidan Khwar | 28.12g | 24.36g | 13.37 |
| Thikar Kot | 28.80g | 25.36g | 11.94 |

## CONCLUSION

It was concluded that among the four locations of Upper Dir, highest disease incidence(%) and disease severity(%) was recorded in Barawal Bandi and Maidan Khwar whereas the other locations i.e. Thikar Kot and Satara were not severely infected with bacterial leaf blight (BLB) disease of rice. It is recommended to

raise awareness in the farming community of Uper Dir about gradual increase bacterial leaf blight (BLB) disease of rice. Further farming community must be trained on management of bacterial leaf blight (BLB) disease of rice to minimize yield losses.

## ACKNOWLEDGEMNTS

The authors are very grateful to Department of Plant Pathology, The University of Agriculture Peshawar for providing facilities to carry out this research.

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