Journal of Advances in Science and Technology

Vol. VIII, Issue No. XV, November-2014, ISSN 2230-9659

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AN INTERNATIONALLY INDEXED PEER REVIEWED & REFEREED JOURNAL

www.ignited.in

Journal of Advances in Science and Technology
Vol. VIII, Issue No. XV, November-2014, ISSN 2230-9659

A Study on the Productivity of Rice in Haryana

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Abstract – Agriculture has remained the backbone of Haryana and remains the primary activity and main livelihood source for the rural population in the state. Besides, agriculture provides raw material for a large number of industries. Agriculture in the state is characterized by wide crop diversification. The extent of arid land in Haryana being second only to Rajasthan in the country, agriculture is highly dependent on the vagaries of the southwest monsoon. Out of the net area sown, only 30 % is irrigated. The most important challenge of agriculture is food security, besides improving the livelihood of the farmer. Haryana has attained self-sufficiency in food grain, but still continues to be deficit in the production of rice. During 2010-11 food grains production is increased at an enormous rate of more than 14 % over the last year production. The production is likely to increase from 110 lakh tones in 2010-11 to 126 lakh tonnes during the current year (FAO, 2011).

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INTRODUCTION

In Haryana rice grown an area of 1.3 million hectare with production of 2.82 mt/h (FAO, 2011). Rice crop is prone to number of bacterial diseases among which bacterial leaf blight caused by Xanthomonas oryzae pv. oryzae is a serious problem and threat to rice production in both tropical and temperate rice growing regions due to its high epidemic potential (Mew, 2010). The disease occurs in the host plant at the seedlings, vegetative and reproductive stages but bacterial leaf blight infection at the tillering stage causes severe blighting of leaves resulting in yield loss up to 75 % depending on weather, location and particular rice cultivar used (Ou, 2009b). The pathogen is seed-borne (Reddy et al., 2009; Singh et al., 2012) and has been considered as an important quarantine organism in many countries. Sowing infected seeds can lead to reduced germination, vigour and yield. Thus seed-borne bacteria act as a primary source of inoculums, may lead to extremely high field incidence of disease, a seed infection usually occurs during the three distinct phases of seed production, seed development and seed maturation, the pathogen can infect the seed and developing plant leading to systemic infection (McGee, 2009). More complete knowledge of the mechanism of seed transmission may lead to better method of controlling disease. Field surveys, estimation of disease incidence, crop loss in field conditions are very important in agriculture. To find out the prevalence of the disease in the particular region and nature of plant pathogen in different situation as well as to demarcate the disease free areas for quality seed production. Field survey plays an important role in assessing the relation of pathogen with weather conditions depending upon the soil and host cultivar, it also helps to know the role of pathogen in the loss of rice yield. In this context field survey is conducted in the present study, to find out bacterial leaf blight incidence across rice growing regions of Haryana, and to characterize X. oryzae pv. oryzae biochemically from the isolates collected from different agro climatic regions of the state.

In Haryana rice is grown under a variety of soils and wide range of rainfall and temperature. Only around 44 % of the total acreage is under irrigation while the rest is under the regime of monsoon. Rice is cultivated in places where the rains are as heavy as 3000 mm and in others where it is just 600 mm. In some areas only one crop is grown and in certain other areas three crops are raised. The unique feature of rice culture in the state is that either sowing or transplanting is seen in all seasons of the year. The duration of the rice varieties cultivated in the state varies from 100 to 180 days depending on season and agro-climatic location.

In Haryana it is highly challenging for the researchers to work with the problems of diversified rice cultivation. Based on the agro-climatic situation, amount and distribution of rainfall, soil type and prevailing agro-climatic practices, rice growing ecosystems of the state can be broadly classified into following six categories.

REVIEW OF LITERATURE

Plants are constantly exposed and threatened by a variety of pathogenic microorganisms present in their environment. Disease caused by pathogen including bacteria and fungi significantly contributes to overall loss of crop yield worldwide (Savary et al., 2006). Bacterial disease caused by Xanthomonas has

devasted various host plants resulting in considerable loss in productivity and quality of harvest (Cavalcanti et al., 2006). Pathovars of Xanthomonas are reported to have developed resistance to several antibiotics such as kanamycin, penicillin, ampicillin, streptomycin etc. Among the Xanthomonads, Xanthomonas oryzae pv. oryzae causes bacterial leaf blight of rice is one of the important diseases of rice in most of the rice growing countries. Management of bacterial leaf blight will be undertaken by using biotic and abiotic resistance inducer of host. The inducer enhances the host defense machinery to produce necessary compound to kill the pathogen soon after its entry into plant system. However, there are many problems associated with controlling pathogens with long term persistent survival structure due to difficulties in reducing pathogen inoculum and lack of plant resistance. Plants have endogenous defense mechanisms that can be induced in response to attack of pathogens. It is well known that the defense genes are inducible genes and appropriate signals are needed to activate them. Inducing the plants own defense mechanisms by prior application of biotic or abiotic inducer is thought to be a novel plant protection strategy. The most promising and effective biological and chemical inducer were selected and attempted to manage this disease.

Bacterial leaf blight has epidemic potential destructiveness to high yielding cultivars in both temperate and tropical countries especially in Asia. In addition bacterial leaf blight has been serious problem in hybrid rice cultivation areas in China and Vietnam. In an effort to combat disease plants have devised various mechanisms. Major difficulty is the lack of effective biocontrol agent against several plant bacterial diseases. On the other hand, application of chemical derivatives has effectively controlled the plants from bacterial disease but threatens the environment hindering the management of disease in crops and agricultural products (Burhan et al., 2009). In the present study a detailed in vitro and in vivo investigation was conducted to test the efficacy of some plant extracts against pathogenic X. oryzae. pv. Oryzae.

RESEARCH STUDY

This is the drill sown rice area, comprising Ambala, Panipat and part of North Haryana district. It has a total of 0.19 m ha. (14.4 % of the area under rice) with 1.12 t/ha of productivity. This area is unique in that rice is direct seeded over 90 % of the area. The crop is direct seeded under relatively dry conditions and the fields remain unflooded for most part of the period. The region receives an annual rainfall of 619 to 1303 mm.

The area under rice in tank-fed is around 0.15 m ha with the productivity of 2.48 t/ha. This region includes the districts of Ambala, Panipat and parts of Sonepat. It covers 11.0 % of the area under rice. This area receives an average annual rainfall of about 760 mm.

It occupies an area of 0.18 m ha, with the productivity of 2.59 t/ha. This includes the canal irrigated areas of Karnal, Jind and parts of Rohtak and Hissar districts. This area receives an annual rainfall of 778 mm.

This occupies an area of 0.21 m ha with the productivity of 2.53 t/ha. It comprises Jind, Rohtak, Narwana and Panipat districts. This region receives an annual rainfall of 600 mm only. The rice growing districts area under cultivation production and yield (kg/hacter) are listed in the (Table1)

Table 1. District-wise production and productivity of rice in Haryana

Districts	Area (ha)	Production (t)	Yield (Kg/ha)
Ambala		210	2541
Jind	2119	6738	3347
Rohtak	2293	8183	3857
Narwana	71269	89459	1322
Panipat	122721	410503	3521
Hissar	6503	3435	657
Majra	12	29	2544
Sonepat	19294	54673	2983
Tarori	8122	26356	3416
Karnal	43789	106000	2548
Ghraunda	8667	18410	2236
Samalakha	55372	132894	2526
Davanagere	130208	428172	3461
Dharwad	32834	35398	1135
Nilokheri	1905	3055	1688
Dhaand	92740	157008	1782
Pundri	53146	128074	2537
Hansi	51669	64709	1818
Cheeka	35362	88096	2622
Shahbad	4157	7621	1930
Kaithal	75223	245003	3428

Field survey was undertaken in major rice growing regions of Haryana India. During the months of June to November 2012 and February to June 2013. During the field survey the plants were inspected at the nursery stage, after transplanting, and at the flowering stage. Bacterial leaf blight incidence was recorded, among the randomly selected subplots of $1m^2$ each (10 subplots/hectare). Plants were diagnosed as infected on the basis of typical symptoms of bacterial leaf blight, viz., yellow water soaked lesions at the margin of the leaf blade, the lesions run parallel along the leaf, bacterial discharge appears on young lesion early in the morning that looks like a milky dew drop, as the disease progress the leaf dries up with white lesions and the leaf blade as wavy margin.

CONCLUSION

In the present study, field survey was undertaken in the major rice growing region of Haryana and the study revealed that the bacterial leaf blight disease incidence ranged from 12 to 75 %. Bacterial leaf blight of rice is highly destructive, wide spread disease and is a threat to rice production in both temperate and tropical rice growing region due to its high epidemic potential (Mew, 2010) it is particularly destructive in Asian countries during heavy rains of monsoon. The disease occurs in the host plants at the seedling, vegetative, and reproductive stages, but bacterial leaf blight infection at the tillering stage causes severe yield loss of up to 75% depending on weather, location and particular rice cultivar (Ou 2009a). Xanthomonas oryzae pv. oryzae is a seed-borne, occurring in glumes and occasionally within the endosperm, seed collected from heavily diseased fields seedlings grown from such seeds usually shows disease symptoms and die at an early stage (Srivastava and Rao 2011). In our studies none of the field surveyed were free from disease incidence. Most of the popular cultivars of rice viz, IR20, Jaya, Jyothi, IR64 were recorded more than 30 % of the disease incidence.

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