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Effect of shade cast by akashmoni tree on the incidence of diseases in aman rice (cv. Kalojira)

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Abstract: The study was carried out at the Field laboratory, Department of Agroforestry, Bangladesh Agricultural University, Mymensingh during the period from August to November 2015 to observe the on the incidence of diseases in aman rice cv. Kalojira due to effect of shade cast by akashmoni tree. Symptoms and severity of brown spot, blast, bacterial leaf blight (BLB) and sheath blight of rice were recorded in North, South, East and West orientations of akashmoni tree. The result showed that the light intensity had direct impact on the development of rice diseases and also found that increase of light intensity significantly decreased the disease severity of rice. In case of Brown spot and Blast diseases, South orientation received the highest light intensity and it produced the lowest (38.22% and 15.08%) disease severity followed by East (43.62% and 20.33%) and West (40.75% and 18.03%) respectively, while North orientation showed the highest disease severity due to its poor light penetration. In case of BLB and Sheath blight, South orientation received the highest light intensity and it showed the lowest (25.06% and 14.38%) disease severity followed by West (29.58% and 14.80%) and East (30.47% and 16.70%) respectively. Highest Bacterial leaf blight and Sheath blight severity was found in North orientation. On the other hand light intensity in the control plot (outside of the akashmoni tree) was maximum (100%) in brown spot, blast, bacterial leaf blight and sheath blight and it caused minimum severity as compared to other orientations.
Key words: Disease infection, *Acacia auriculiformis*, shade, aman rice, Kalojira.

Introduction

Bangladesh is one of the most densely populated countries in the world having agrarian based economy and rural based settlement. But shortage of fuel and timber wood and environmental degradation is another concern. Deforestation may be more detrimental in the long-run. The country has only a land area of 14.39 million hectares, but due to over growing population, per capita land area is decreasing at an average rate of 0.005 ha/cap./year since 1999 (Hossain and Bari, 1996) and therefore, steadily declining the land: man ratio.

The country has, therefore, to develop combined production systems integrating trees, crop, which is now being called agroforestry. Agroforestry as ‘‘a collective name for all land use systems and practices where woody perennials are deliberately grown on the same land management unit with agricultural crops and animals in some form of spatial arrangement or temporal sequence. There must be significant ecological and economical interactions between the woody and non-woody components’’ (Lundgreen and Raintree, 1982). In Agroforestry system, interaction between trees and crops (or animals) is important because of sharing of the common resources. However, these interactions should take place with respect to how the component of Agroforestry utilizes and shares the resources of the environment and how the growth and development of any of the component will influence the other (Torquebiau, 2004).

Cropland Agroforestry indicates the simultaneous production of trees and annual crops in cropland. Traditional agriculture is often characterized by low output at the cost of relatively high investment resulting also in a deteriorating environment due to toxicity of pesticides and chemical fertilizers. Cropland Agroforestry practices help to overcome this deteriorating environment of traditional agriculture. As the expansion of classified forest is almost impossible because of high population pressure, growing trees in crop field may serve as the best option and to balance the ecosystem. Farmers in our country practice monoculture of Aman rice. But practicing of suitable tree-rice association can increase total production than the mono crop system. In this context, the simultaneous cultivation of rice along with inter-cropping of suitable tree-species, may increased the overall production. Under such production system, the incidence of major rice diseases and their effects on yield is necessary to determine. Keeping this view in mind, the present piece of research has been undertaken to determine the shade effect of Akashmoni tree on the incidence of major diseases of rice under tree-rice based agroforestry system.

Materials and Methods

Experimental site and season: The experiment was conducted at the experimental farm (Plate 1), Department of Agroforestry, Bangladesh Agricultural University, Mymensingh during the August-November 2015.

Plate 1. Aman rice field under Akashmoni tree

Experimental design: The experiment was carried out following RCBD with three replications and different orientations were considered as treatments in the study. The treatments were OO = Open field (outside of the tree canopy), ON = North side from the tree base, OS = South side from the tree base, OE = East side from the tree base, and OW= West side from tree base

Recording of diseased severity in the field: Leaf/sheath area diseased (LAD) under natural condition were recorded at flag leaf stage. Twenty hills from the sampling area in each orientation were selected randomly are tagged. The severity of blast, brown spot, bacterial leaf blight and sheath blight were recorded following standard

grading scale (Standard Evaluation System for Rice, 1988).

Considering the diseases severity of the above four diseases, the infection index (%) of all diseases were estimated following the method of Singh (1984): Infection index (%) = [{(Sum of all numerical disease rating) ÷ (Total no. of ratings maximum diseases grade)} ×100].

Statistical analysis of the data: The data collected at final harvest were computed and analyzed following the appropriate design of the experiment. Duncan's new multiple range tests were done in order to show the significant differences between the treatment means (Zaman *et al*., 1982).

Results and Discussion

Effect of different orientations on the incidence of Brown spot of disease of rice under the Akashmoni tree: Among the orientations four plots, the highest Brown spot severity was (47.20) observed in North orientation (ON). The lowest result was (38.22) found in South orientation (OS). The result also revealed that with the absent of Akashmoni tree (open field) the disease severity grade was (34.00) the lowest in compared to the all orientations (Fig. 1). On the other hand with the absent of Akashmoni tree, light penetration was 100% in open field and thus disease severity was the minimum in compared to all of the orientations. Abe, 1931, observed the infection *Piricularia oryzae* in rice at shade condition.

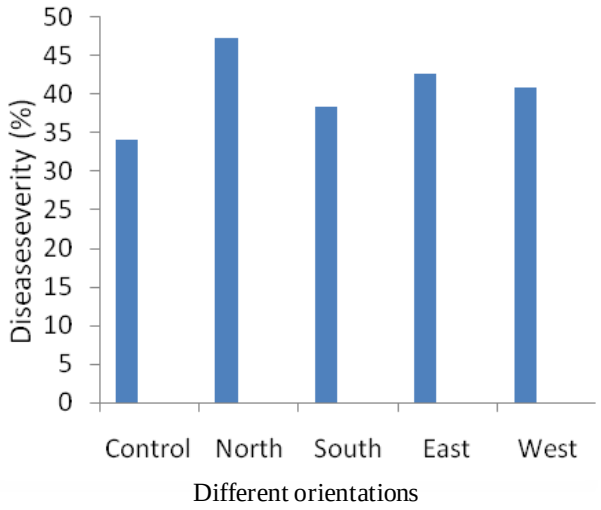

Fig. 1. Effect of different orientations on the incidences of brown spot disease of rice under akashmoni tree.

Effect of different orientations on the incidence of Blast disease of rice under Akashmoni tree: The result revealed that among the four orientations the highest disease severity (infection index) of blast was (22.126) found in the North orientation (ON) from the base of Akashmoni tree. The lowest result was (16.183) observed in the South orientation (OS). In case of open filed (OO) the result showed that with the absent of Akashmoni tree the disease severity was (13.33) the minimum compared to all orientations (Fig. 2). From the above result it observed that decrease of light penetration increase the disease severity grade under the different orientations in Akashmoni tree. In Bangladesh condition shade effect was severe in North-East orientation and thus it produced highest disease incidence. Imura, 1938, observed the blast disease of rice in shade condition.

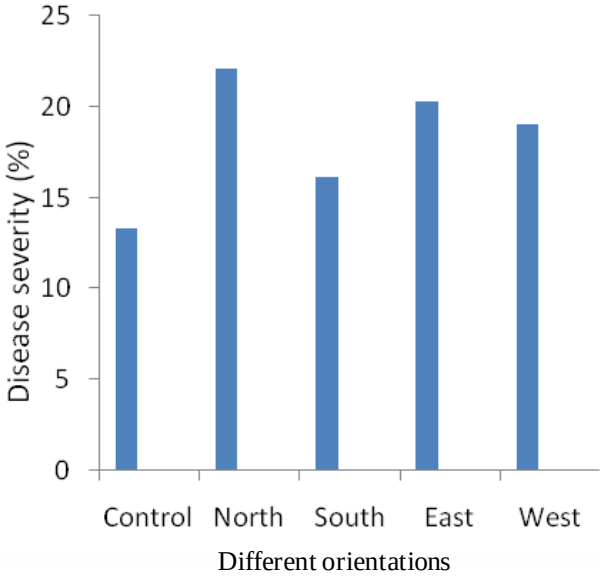

Fig. 2. Effect of different orientations on the incidences of blast disease of rice under akashmoni tree.

Effect of different orientations on the incidence of Bacterial Leaf Blight (BLB) disease of rice under Akashmoni tree: The result observed that among the four different orientations, the highest disease severity grade of bacterial leaf blight was (33.75) found in North orientation (ON) and the lowest result was (25.06) found in South orientation (OS). With the absent of akashmoni tree control (OO) produced the lowest BLB severity compared to that of all orientations. Consequently with the highest shade effect, North orientation developed the maximum severity of BLB disease (Fig. 3). Naito, 1973, observed the *Healminthosporium* disease of rice in shade condition.

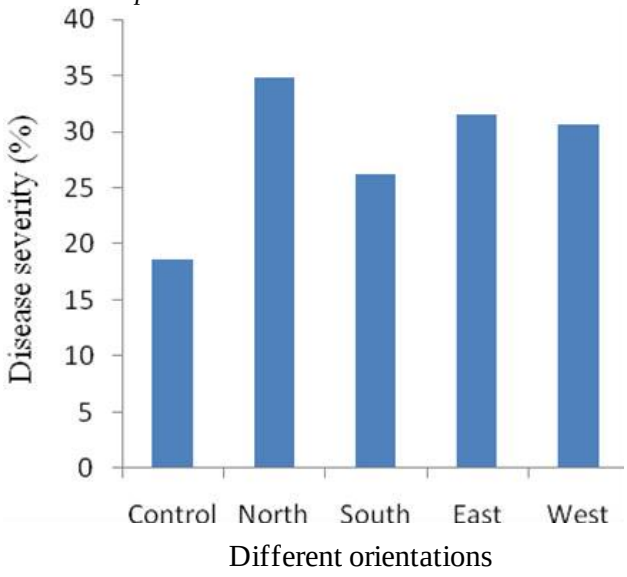

Fig. 3. Effect of different orientations on the incidences of BLB disease of rice under akashmoni tree.

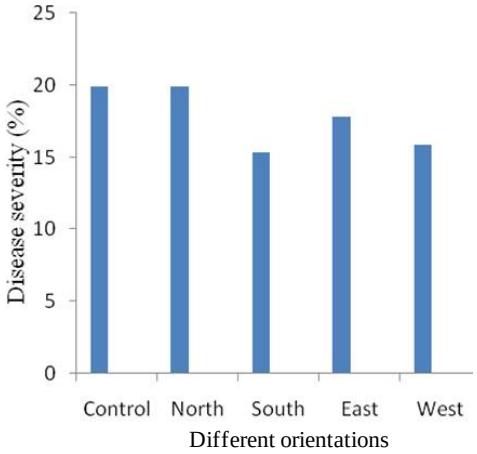

Fig. 4. Effect of different orientations on the incidences of sheath blight disease of rice under akashmoni tree.

Effect of different orientations on the incidence of Sheath blight disease of rice under akashmoni tree: The result showed that among the four different orientations the disease severity grade of Sheath blight disease was the highest (18.776) in North orientation (ON). The lowest result was (14.276) found in South orientation (OS). In case of control the disease severity grade was the (12.83) the minimum in compared to all orientations. Among four orientations, light penetration was the highest in South orientation and it enhanced lowest infection index of Sheath bligt disease (Fig. 4).

Effect of akashmoni tree shade on yield and yield characteristics of cv. Kalojira rice: Profound effect of tree-rice association was observed on plant height, panicle length, grains panicle^{-1}, 1000 grain weight, and yield (Table 1).

Table 1. Yield and yield contributing characters of rice cv. Kalojira

Tree-rice association	Plant height (cm)	Length of panicle (cm)	Grain panicle $^{-1}$	Yield ton/ha	Straw ton/ha	1000 grain weight (g)
T_0(open)	109.52a	23.8a	94.5a	2.21a	13.3a	21.3a
T_1(Akashmoni)	109.49b	22.5b	84.8b	1.71b	11.4b	21.2a
Probability	0.0365	0.0031	0.9196	0.0059	0.3256	0.0018

In a column, the figures having different alphabets are significantly different at 5% level of probability

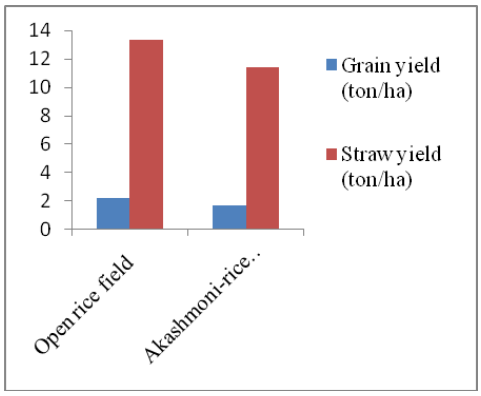

Fig. 5. Amount of yield and straw of open rice field and akashmoni-rice association

Yield: A significant difference was present between open rice field and akashmoni-rice association (Fig. 5). In open rice field, yield is 2.21 ton/Acre. In akashmoni-rice association yield is 1.71 ton/ha. Yield reduction of rice under tree-rice association observed in the present study might be due to the resulting from the shading effect.

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