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Incidence of Leaf Spot of Mustard in Akashmoni-mustard Based Agroforestry System

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Abstract: The incidence of leaf spot of mustard (cv. BARI sharisha 13) grown in different orientations and distances under around twelve years old Akashmoni (*Acacia auriculiformis*) tree was studied in the field laboratory of the Department of Agroforestry, BAU, Mymensingh during 2004-05. The assessment result showed that the disease incidence was higher near the tree base in every side (1 m from the tree base) and higher in North side in all distances at different date of sowing. The lowest disease incidences were found in South orientations 3 m from the tree base and highest in North 1 m from the tree base. The siliqua infection significantly influenced on crop yield. The highest seed yield was observed in South orientation 3 m from the tree base and lowest in North 1 m from the tree base plot. The distance and orientation showed marked effect in disease development at different date after sowing. In open field condition (control) disease incidence also affect on yield and statistically different from tree-crop combination.

Key words: Incidence, leaf spot, mustard, orientations, distances and akashmoni

INTRODUCTION

Bangladesh has the lowest per capita land due to its high population density. This limited land resources are engaged in producing minimum food require for the people. Official records reveal that 12.8% of the hand area of Bangladesh is under forest. However, actual tree coverage is only 5 to 6% (FMP, 1992). In Agroforestry system interaction between trees and crops (or animals) is important because of sharing of the common resources. However, these interaction should take place with respected to how the component of Agroforestry utilizes and shares the resources of the environment and how the growth and development of the compost will influenced the other (Torquesiau, 1994).

Rape-seed mustard suffers from at least 10 disease in Bangladesh (Meah *et al*., 1985; Bari, 1985). *Alternaria* blight has been recognized as the most serious and devastating disease of rapeseed- mustard in the country (Meah *et al*., 1985; Bari, 1985) Alternaria bight or leaf spot of mustard is caused by *Alternaria brassica* (Berk) zacc. The disease caused blight of leaf, Pod and stem (Meah *et al*., 1988) and seed abnormalities (Howlider *et al*., 1991). It is endemic in Bangladesh and all cultivated varieties are susceptible. The disease caused an average yield loss 30-60% in Bangladesh (Meah *et al*., 1988; Fakir, 1980).

In this study, if we practice the simultaneous cultivation of mustard along with intercropping of suitable tree-species, the overall production may be increased under such production system and for this the incidence of leaf spot of mustard need to be determined. Therefore, the present research work was designed to determine the incidence of leaf spot of mustard under Akashmoni (*Acaciq auriculiformis*), so that the Akashmoni-Mustard Agroforestry system can introduced in our farming system after harvesting *T. aman* rice in rabi season successfully.

MATERIALS AND METHODS

The study was conducted during Rabi season of 2004-2005 in the Agroforestry field laboratory, Bangladesh Agricultural University, Mymensingh. The cultivar "BARI Sharisha 13 (*Brassica napus*) of mustard was used in the study. The experiment was carried out under 12-years old plantation of Akashmoni established by the Village Farm Forest Project (VFFP) area in the Agroforestry field laboratory. The experiment area covered 1500 m^2 including the borders and the open area for control plots. The experiment was used one row of trees involving trees of the Akashmoni species. The experiment was carried out by RCBD design with three replications. The two factors i.e., orientations and distances from the tree species involved in the study.

The Orientations were O_1 = South, O_2 = West, O_3 = North and O_4 = East, and Distances from the tree base were D_1 = 1 m distance from the tree base,

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D_2 = 2 m distancefromthe tree base, D_3 = 3 m distance from the tree base and D_0 = (Open field) means-outside the tree canopy. The distance 1 m from the tree base was selected because farmers usually donot want to waste any land. So they cultivate all areas having about 1m around each tree (for 12-years-old tree). The size of each plot were 1×1m. The crown diameter of each of the three trees was measured along North-South and East-West axis using measuring tape. The dose of fertilizers and manures were applied in the field as recommended by BARI according to cultivation manual (Anonymous, 2004). Seed rate was 8 kg ha^{-1}. The seeds were sown in line. The line to line distance were 30 cm and placed at a depth of 2.5-3 cm. After sowing, the seeds were covered with soil. When germination was completed 50-60 plants were kept in each plot. Intercultural operations were done as needed. Data were recorded on % Plant infection,% Leaf infection,% Leaf Area Diseased (LAD),% Total siliqua infection,% Siliqua infection, No. of spots per siliqua, Plant height, No. of branches per plant, Weight of seeds per plant and Weight of seeds per plot.

RESULTS AND DISCUSSION

The effect of different orientation and distance showed significant influence on disease incidence at different days after sowing (Table 1). At 30 DAS disease incidence ranged from 2.58 to 9.20%, where the highest disease incidence was found in O_3D_1 and the lowest disease incidence was found in the plot 3 m from the tree base at south orientation (O_1D_3). In open field (control) the disease incidence was 5.45%. Disease incidence was more in D_1 distance (1 m from the tree base) and gradually decreases in respect to increase in distance. The results are statistically significant. Disease incidence was significantly differing among the treatments in different days after sowing. Disease incidence ranged from 12.70 to 39.95% at 45 DAS, where the highest disease incidence range from 68.94 to 97.89% at 90 DAS. Similar trends were observed in 60 DAS and 75 DAS. Open field (control) showed lower disease incidence.

Percent leaf infection under different condition showed significant difference in different DAS. Significantly the higher percent leaf infection 105.96% at O_1D_3 plot at 75 DAS. The range of leaf infection were 0.00 to 105.96%, where the control plot in open condition showed lower leaf infection ranged 12.50 to 88.89% at 30 DAS to 75 DAS. The infection range gradually increased in different plots in order to decrease of distance and increase in DAS (Table 2).

Leaf infection first appeared at 30 DAS both in control plot and under trees. The leaf area diseased varied from 2.53 to 67.97%, where the lowest were found in O_2D_3 at 30 DAS and the highest in O_3D_1 at 75 DAS. Percent leaf area diseased ranged from 10.0 to 36.65% in control plot (open field) at 30 to 75 DAS (Table 3).

The plot result were significantly differs on percent siliqua infection in the main rachis at different DAS. Lowest infection was observed at O_1D_2 (15.52%) at

Table 1: Influence of orientations and distances on disease incidence (%) of rapeseed mustard (var. BARI sharisha 13) under Akashmoni tree

Treatments	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS
O_1D_1	4.37c	14.24j	20.26i	72.08e	76.62k
O_1D_2	4.29c	12.70l	13.54j	37.65j	69.14l
O_1D_3	4.73c	13.29k	12.13k	40.99k	68.94l
O_2D_1	2.70e	19.53g	35.85g	78.77d	86.30g
O_2D_2	3.38d	18.71h	35.51g	44.52i	82.19i
O_2D_3	4.67c	18.62h	36.17g	54.61h	84.72h
O_3D_1	5.56b	39.95a	87.91a	84.51a	97.89a
O_3D_2	8.78a	27.76d	57.94d	83.33b	96.53b
O_3D_3	9.20a	24.81f	53.99e	92.45c	91.77f
O_4D_1	2.58e	32.76b	72.17b	83.44b	94.04d
O_4D_2	4.73c	30.59c	61.81c	67.36f	93.06e
O_4D_3	4.60c	25.63e	48.04f	63.51g	95.95c
Control	5.45b	17.73i	30.45h	72.22e	79.63j
SD	0.15	0.18	0.26	0.26	0.16

Figure in a column having the same letter (s) do not differ significantly as per DMRT at 1% level of provability

Table 2: Influence of orientations and distances on percent leaf infection of rape-seed mustard (var. BARI sharisha 13) under Akashmoni tree

Treatments	30 DAS	45 DAS	60 DAS	75 DAS
O_1D_1	14.29g	25.65k	33.66i	91.80h
O_1D_2	7.14k	28.74i	25.29k	96.18e
O_1D_3	0.00l	7.39l	12.80m	105.96a
O_2D_1	9.08i	54.30e	47.23e	99.48b
O_2D_2	7.69j	69.85c	65.21c	94.76f
O_2D_3	0.00m	27.20j	23.08l	90.72i
O_3D_1	49.98c	110.23a	105.68a	97.76d
O_3D_2	44.43d	75.65b	84.11b	98.41c
O_3D_3	55.57b	60.00d	61.60d	94.96f
O_4D_1	62.50a	40.35h	41.34g	97.51d
O_4D_2	39.99e	51.63f	45.11f	72.33k
O_4D_3	25.00f	43.33g	37.30h	93.64g
Control	12.50h	27.58j	30.54j	88.89j
SD	0.032	0.145	0.284	0.157

Figure in a column having the same letter (s) do not differ significantly as per DMRT at 1% level of provability

Table 3: Influence of orientations and distances on%leaf area diseased of rape-seed mustard (var. BARI sharisha 13) under Akashmoni tree

Treatments	30 DAS	45DAS	60 DAS	75DAS
O_1D_1	4.53cd	9.663bcd	23.33d	56.82bcde
O_1D_2	4.00cd	8.64cd	19.95d	57.93bcd
O_1D_3	5.02bcd	10.08bcd	26.43cd	47.67f
O_2D_1	6.40bcd	11.147cd	22.79d	59.97abcd
O_2D_2	2.83d	7.783bcd	24.59cd	59.63abcd
O_2D_3	2.53d	6.38cd	20.46d	48.80ef
O_3D_1	16.30a	22.89a	51.22a	67.97a
O_3D_2	15.50a	21.21a	40.93b	62.83ab
O_3D_3	15.83a	22.363a	40.77b	53.17cdef
O_4D_1	7.57bcd	15.347b	33.31bc	61.10abc
O_4D_2	7.72bcd	13.00bc	28.33cd	60.27abcd
O_4D_3	8.30bc	12.563bcd	24.60cd	51.08def
Control	10.00b	7.088cd	23.08d	36.65g
SD	1.59	1.99	3.00	2.81

Figure in a column having the same letter (s) do not differ significantly as per DMRT at 1% level of provability

Table 4: Effect of orientation and distance on percent siliqua infection 30 cm from the top of the plant of rape-seed mustard variety BARI sharisha 13 at different days after sowing

Treatments	45 DAS	60 DAS	75 DAS	90 DAS
O_1D_1	15.94i	23.68j	27.73g	33.87g
O_1D_2	15.52i	23.09j	21.82h	24.66h
O_1D_3	17.91h	26.77i	22.04h	25.75h
O_2D_1	39.27f	65.17g	41.06d	46.31d
O_2D_2	37.29g	66.25g	36.70ef	41.93e
O_2D_3	37.67fg	54.87h	35.46f	40.33ef
O_3D_1	78.65a	147.36a	66.16a	69.31a
O_3D_2	53.22d	73.87f	67.75a	63.51b
O_3D_3	57.64c	97.64d	40.78d	38.42f
O_4D_1	65.11b	115.64b	64.11b	69.90a
O_4D_2	53.29d	92.77e	52.35c	55.45c
O_4D_3	49.85e	101.93c	38.63e	41.01ef
Control	12.41j	14.61k	20.57h	20.69i
SD	0.601	0.829	0.686	0.997

Figure in a column having the same letter (s) do not differ significantly as per DMRT at 1% level of provability

Table 5: Effect of different orientations and distance on yield and yield contributing characters of mustard (vir. BARI sharisha 13) as influenced by leaf spot of mustard disease

Treatments	Plant height	No. of branches	Total no. of siliqua/plant	Weight of seeds/plant (g)	Weight of seeds/plot (g)
O_1D_1	66.94d	3.94d	64.00bc	3.35ab	261.7abd
O_1D_2	83.43c	5.39c	61.07cd	3.433ab	261.7abc
O_1D_3	103.50b	5.82b	67.03ab	3.503ab	266.7abc
O_2D_1	106.86b	2.33f	42.00fg	3.2bc	251.7cd
O_2D_2	111.21b	5.07c	67.93a	3.13bcd	250.0cd
O_2D_3	122.54a	5.07c	55.07e	3.233b	261.7abc
O_3D_1	64.20d	2.14f	31.70i	1.80f	158.3e
O_3D_2	70.33d	4.20d	41.00g	1.783f	165.0e
O_3D_3	84.43c	4.20d	45.37f	1.767f	166.7e
O_4D_1	68.33d	3.26e	36.37h	2.717e	245.0d
O_4D_2	84.75c	4.35d	55.48e	2.85cde	253.3bcd
O_4D_3	104.53b	5.13c	57.82de	2.827de	255.0abcd
Control	126.83a	6.85a	69.30a	3.62a	270.0a
SD	3.2	0.14	1.30	0.12	4.55

Figure in a column having the same letter (s) do not differ significantly as per DMRT at 1% level of provability

45 DAS and highest at O_4D_1 at 90 DAS (69.90%). Control plot showed moderate siliqua infection ranged 12.41% to 20.69% at 45 DAS to 90 DAS (Table 4).

The plant grown under O_0-orientation (outside the tree canopy) produced the tallest plant (126.8 cm) from other orientations. The smallest plant (64.20 cm) was produced in O_3D_1 north-1 m from tree base In all orientations plant heights were gradually increased in different distance from the tree base and gradually reduced near in 1 m distance from the tree base. The variation in number of branches was distinct in O_0 (open field) compared to other orientations. The highest number of branches was obtained from O_1D_3 orientation (5.81) and the lowest was in O_3D_1 orientation (2.14). The number of branches/plant varied from 2.14 to 6.85. A significant different was showed in total number of siliqua/plant by different orientation and distance. The maximum number of siliqua per plant (67.93) was found in O_2D_2, which was statistically similar to O_1D_3(67.03), the minimum number of siliqua per plant (31.70) found in O_3D_1 combination. The effect of orientation and distance was statistically significant on seed weight per plant. The highest seed weight (3.6 g) was recorded from O_0 (open field) and the lowest (1.76 g) was recorded from O_3D_3 (North-1 meter from tree base) orientation that was gradually increased in different orientations. Weight of seeds/plot under different treatment combinations ranged from 158.3g to 270.0 g, while the maximum weight of seeds/plot was obtained from the plants of control (O_0) (Table 5). Seed weight/plot was found to vary significantly from one orientation to another.

Alternaria blight of mustard an endemic disease caused by *Alternaria brassicae* and *Alternari brassicicola* is a most devastating disease in Bangladesh. It also reported that *Alternaria* causes infection on almost all above ground parts of mustard plant and eventually becomes transmitted from plant to seed and seed to seedling (Meah *et al*., 1988; Fakir, 1976). Symptoms of the disease as observed in the present study confirm to those describe by Kimber and McGregor (1995). *Acaci auriculiformis* (Akashmoni) is a leguminous plant and mycorhizal association of the species have been carried out in Bangladesh Mridha *et al*. (1999) and the rhizosphere zone favoured fungi for much multiplication. Soil properties and microorganism might be influenced by root after the associate plants and their disease infection. Degree of infection of *Alternaria brassicase* largely depends on factor like wetness of both soil and sir temperature (<20°C) and also leaf wetness. These might be the cause for variation in infection of the pathogen in different distance form the tree base. Result obtained by Singh *et al*. (1992) reported that low temperature (10-15°C min, 24-27°C max) and high RH 80-90% increase the disease intensity and the development of disease highly significant on crop growth stages. The critical stage of disease development is important progressive growing stage of plant and developing pods at 30 DAS. It might be considered as the critical stage of disease development. Disease symptom first appears at 30 DAS and gradually increased. Siliqua are important components of yield of mustard. It is fact that infection of siliqua greatly affects yield. Siliqua infection and siliqua spotting in different orientation and distance from the tree base were statistically significant. As there was no direct report on leaf spot of mustard disease incidence in tree-mustard Agroforestry system but the downey mildew and white rust is directly influence by shade and the other disease such as angular leaf spot, anthracnose of bean, powdery mildew of milon, blast of rice disease incidence are also enhance by shade in tree

crop Agroforestry system. Yield reduction due to *Alternaria blight* of mustard different orientation and distance observe in the present study. No similar result was found.

Results of the study reveal that Akashmoni trees had significant influence on *Alternaria* blight disease incidence as well as decreases yield in different distances and orientations.

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