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Combined management of cercospora leaf spot and anthracnose in okra seed production

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Abstract: Effect of different management practices either single or in combination was investigated for combined management of cercospora leaf spot and anthracnose in okra seed production. The pot experiment was conducted taking eleven management practices viz., soil amendment with mustard oil cake, seed treatment with BAU-Biofungicide (0.2%), soil application of kitchen ash, seed treatment with carbendazim (0.1%), spraying suspension of BAU-Biofungicide (0.2%), foliar spray of carbendazim (0.15%), seed treatment with BAU-Biofungicide (0.2%) + spraying suspension of BAU-Biofungicide (0.2%), seed treatment with carbendazim (0.1%) + foliar spray of carbendazim (0.15%), soil amendment with mustard oil cake + foliar spray of carbendazim (0.15%), soil application of kitchen ash + foliar spray of carbendazim (0.15%) and control. Among the treatments, soil amendment with mustard oil cake (50 g/pot) along with foliar application of carbendazim (0.15%) at 65 days after sowing followed by two more spray at 15-day intervals were found most effective with lower disease incidence (8.08% leaf area infection in cercospora leaf spot and 9.09% fruit infection in anthracnose), & maximum seed yield (22.03 g/plant), 1000-seed weight (62.31 g), germination (97%) and vigour index (4009).
Key words: Okra, seed production, cercospora leaf spot, anthracnose, management.

Introduction

Okra, *Abelmoschus esculentus* Moench is one of the important vegetable crops in Bangladesh grown extensively in kharif season. Its tender green fruits are used as vegetables having nutritive values like protein, vitamins, and minerals. During the year 2006-2007 the cultivated area and production was 23000 acres and 39000 tons, respectively. The average seed yield of okra is only 1.69 ton/acre in Bangladesh which is very low than many other countries of the world (Anon., 2008).This crop is vulnerable to many diseases like fungal, viral, and nemic. Anam *et al*. (2002) reported five seed-borne fungal diseases of okra in the field, viz, cercospora leaf spot, anthracnose, stem rot, corynespora and ascochyta blight. Among them, cercospora leaf spot and anthracnose are the most important one (Singh, 1999). Shooty-black angular spots appear due to *Cercospora abelmoschi* and causes severe defoliation of the okra plants. *Colletotrichum dematium var. trancutum* is a soil-borne as well as seed-borne pathogen. The acervuli of the fungus frequently appear as black dots on the surface of the mature fruit and in advanced stage of infections seeds are affected (Rangaswami, 1988; Mehrotra and Aggarwal, 2003). Number of reports is available on the management of cercospora leaf spot (Beura *et. al.* 2007; Singh *et. al.*, 2001) and anthracnose (Sinha *et al*., 2001; Singh, 1999) of okra. But information's on the combined management of cercospora leaf spot and anthracnose disease of okra particularly on seed production is limited is this country. Therefore, the present investigation has been undertaken to evaluate the different management practices (seed treatment, soil amendment and foliar spray) against cercospora leaf spot and anthracnose disease in okra seed production.

Materials and Methods

The experiment was conducted both in the net house and laboratory of Plant Pathology Department, Hajee Mohammad Danesh Science & Technology University (HSTU), Dinajpur during the period from May, 2008 to September, 2008. Seeds of okra cv. OK-285 of Lal Teer Seed Company were collected from local market. The pot experiment was carried out taking eleven treatments which were T_1 = Soil amendment with mustard oil cake; T_2 = Seed treatment with BAU-Biofungicide (0.2%); T_3 = Soil application of Kitchen ash; T_4 = Seed treatment with carbendazim (0.1%); T_5 = Spraying suspension of BAU-Biofungicide (0.2%); T_6 = Foliar spray of carbendazim (0.15%); T_7 = Seed treatment with BAU-Biofungicide (0.2%) + spraying suspension of BAU-Biofungicide (0.2%); T_8 = Seed treatment with carbendazim (0.1%) + foliar spray of carbendazim (0.15%); T_9 = Soil amendment with mustard oil cake + foliar spray of carbendazim (0.15%), T_{10} = Soil application of Kitchen ash + foliar spray of carbendazim (0.15%) and T_{11} = Control. Pot soil was prepared by mixing sandy loam soil, sand and well decomposed cowdung (3:1:1). Earthen pots (12" X 9") were taken and cleaned with water and then filled with 5 kg soil. Mustard oil cake and kitchen ash were used as soil amendment @ 50 g/pot and 100 g/pot, respectively. Before sowing, apparently healthy, mature and disease free seeds were surface sterilized with 10% Chlorox solution for about one minute and subsequent washing were done with distilled water for three times. Seed treatment with carbendazim and BAU- Biofungicide were done @ 0.1% and 1:40 w/w (BAU-Biofungicide:seed). After 7 days of amendment with mustard oil cakes, seed were sown according to treatments. Each pot received 3 seeds in equal distance in mid position. Later, one healthy and uniform sized seedling was kept in each pot. Foliar spray of carbendazim (0.15%) and BAU-Biofungicide (0.2%) were done at the first cercospora leaf spot symptom initiation (65 days after sowing) with the help of hand sprayer followed by two more spray at 15-day intervals. cercospora leaf spot severity (as percent leaf area infection) was recorded at 10-days after last spraying. Mature and dried fruits were harvested three times. In each harvesting, fruits were brought to the laboratory and clean slides were prepared from those fruits. The confirmation of the infection of anthracnose pathogen (*Colletotrichum dematium var. trancatum*) was made by studying the characteristics of the fruiting bodies (acervuli) present in the microscopic field at magnification 10X. Plant height was measured at final harvesting. After that, seed yield/plant (g) and 1000-seed weight (g) were measured. Germination test of the harvested seeds was done by using sand method (Agrawal, 1995). Seed vigour for every treatment was determined according to the formula (Abdul-Baki and Anderson, 1973) as follows: Vigour index = [Mean of root length (cm) + Mean of shoot length (cm)] X Percentage of seed germination.

The experiment was carried out following CRD design with five replications. Data were analyzed using analysis of variance technique by DMRT with a statistical computer package program MSTAT-C.

Results and Discussion

The results of the effect of different management practices on plant height, cercospora leaf spot severity, fruit infection due to anthracnose, seed yield and 1000-seed weight is presented in the Table 1. The results showed that highest plant height (120.9 cm) was found in T_1 (soil amendment with mustard oil cake) while it is lowest (85.21 cm) in T_3 (soil application of kitchen ash). The severity of cercospora leaf spot was significantly differed with the different management practices. The minimum percent leaf area infection (%LAI) was observed (7.79%) in T_8 [seed treatment with carbendazim (0.1%) + foliar spray of carbendazim (0.15%)] which was at par with T_9 [soil amendment with mustard oil cake + foliar spray of carbendazim (0.15%)], T_{10} [soil application of kitchen ash + foliar spray of carbendazim (0.15%)] and T_6 [foliar spray of carbendazim (0.15%)]. This was followed by T_7 [seed treatment with BAU-Biofungicide (0.2%) + spraying suspension of BAU-Biofungicide (0.2%)], T_5 [spraying suspension of BAU-Biofungicide (0.2%)] and T_4 [seed treatment with carbendazim (0.1%)]. The leaf area infection with T_4 [seed treatment with carbendazim (0.1%)] was statically at par with T_1 (soil amendment with mustard oil cake) and T_2 [seed treatment with BAU-Biofungicide (0.2%)]. The maximum %LAI was found (46.16%) in T_{11} (Control). The intensity of anthracnose disease significantly influenced with the application of different management practices. The lowest percent of fruit infection (%FI) was recorded (8.33%) in T_8 [seed treatment with carbendazim (0.1%) + foliar spray of carbendazim (0.15%)] while it was highest (100.0%) in T_{11} (Control). The efficacy the treatment to control the disease was statistically similar with T_9 [soil amendment with mustard oil cake + foliar spray of carbendazim (0.15%)] which was followed by T_{10} [soil application of kitchen ash + foliar spray of carbendazim (0.15%)], T_4 [seed treatment with carbendazim (0.1%)], T_7 [seed treatment with BAU-Biofungicide (0.2%) + spraying suspension of BAU-Biofungicide (0.2%)], T_5 [spraying suspension of BAU-Biofungicide (0.2%)], T_2 [seed treatment with BAU-Biofungicide (0.2%)], T_1 (soil amendment with mustard oil cake) and T_3 (soil application of kitchen ash), respectively.

Statistical results showed significant difference among the treatment regarding seed yield per plant. The highest seed yield per plant (22.03 g) was recorded in T_9 [soil amendment with mustard oil cake + foliar spray of carbendazim (0.15%)] followed by T_8, [seed treatment with carbendazim (0.1%) + foliar spray of carbendazim (0.15%)] T_{10} [soil application of kitchen ash + foliar spray of carbendazim (0.15%)], T_7 [seed treatment with BAU-Biofungicide (0.2%) + spraying suspension of BAU-Biofungicide (0.2%)], T_5 [spraying suspension of BAU-Biofungicide (0.2%)], T_4 [seed treatment with carbendazim (0.1%)] and T_1 (soil amendment with mustard oil cake), respectively. The lowest seed yield per plant (10.68 g) was recorded in the untreated control plants. Present observation shows that after different disease management practices (seed treatment, soil amendment and foliar spray), percent seed yield over control increased in every cases and the range was 4.40 to 106.27%. Incase of 1000-seed weight, the uppermost seed weight (62.31 g) was obtained from T_9 [soil amendment with mustard oil cake + foliar spray of carbendazim (0.15%)] while it was lowest (52.18 g) from T_{11} (Control) plants. The performance of T_9 [soil amendment with mustard oil cake + foliar spray of carbendazim (0.15%)] in respect of 1000-seed weight was at par with T_{10} [soil application of kitchen ash + foliar spray of carbendazim (0.15%)], T_8 [seed treatment with carbendazim (0.1%) + foliar spray of carbendazim (0.15%)], T_7 [seed treatment with BAU-Biofungicide (0.2%) + spraying suspension of BAU-Biofungicide (0.2%)], T_6 [foliar spray of carbendazim (0.15%)] and T_5 [spraying suspension of BAU-Biofungicide (0.2%)] which was followed by T_3 (soil application of kitchen ash) and T_1 (soil amendment with mustard oil cake), respectively.

Table 1. Effect of different management practices on cercospora leaf spot, anthracnose and seed yield of okra

Treatment	Plant height (cm)	Cercospora leaf spot	Anthracnose	Seed yield / plant (g)	% Yield increased over control	1000-seed weight (g)
		LAI (%)	FI (%)			
T_1	120.9	36.95	85.76	14.51	35.86	55.47
T_2	90.47	37.19	83.33	12.01	12.45	54.21
T_3	85.21	43.87	87.50	11.15	4.40	53.88
T_4	101.3	20.29	37.50	15.89	48.78	56.16
T_5	94.70	17.63	71.43	16.30	52.62	60.26
T_6	95.47	9.940	14.07	18.13	69.76	60.89
T_7	89.50	15.42	57.14	17.41	63.02	60.37
T_8	99.97	7.79	8.33	19.89	86.24	62.07
T_9	120.0	8.08	9.09	22.03	106.27	62.31
T_{10}	104.7	9.51	14.07	18.78	75.84	61.11
T_{11}	89.34	46.16	100.0	10.68	-	52.18
$LSD_{(P=0.05)}$	3.712	2.723	2.897	2.534	-	2.536

LAI (%) = Percent leaf area infection, FI (%) = Percent fruit infection

In this study, foliar application of carbendazim (0.15%) showed good results in respect of cercospora leaf spot disease severity along with maximum seed yield. Beura *et al.*(2007) worked with seven different fungicides viz., carbendazim 0.15%, copper oxy-chloride 0.3%, mancozeb 0.3%, propineb 0.25%, thiophanate methyl 0.1%, copper hydroxide 0.3% and ziram 0.25% for the management of cercospora blight disease in okra and found that three sprays of carbendazim at 10 days interval at the initiation of disease significantly recorded lowest disease incidence and maximum seed yield. Among the non-chemical treatments, foliar spray of BAU-Biofungicide (0.2%) produced good effect against cercospora leaf spot. Galletti *et al.* (2004) studied with two fungicidal applications along with bio-control agent *Trichoderma harzianum* and confirmed the effectiveness of *Trichoderma harzianum* foliar applications for reducing cercospora leaf spot of sugar beet. Considering the combined management of both the diseases, soil amendment with mustard oil cake (50 g/pot)along with foliar application of carbendazim (0.15%) at 65 days after sowing followed by two more spray at 15-day intervals were found most effective. Singh *et al.* (1994) worked with five fungicides (carbendazim, mancozeb, zineb, tridemorph and dithianon) to control of anthracnose (caused by *Colletotrichum dematium*) and leaf spots (caused by *Cercospora canescens*) of *Vigna mungo* in India and stated that the highest yield, max. control of both diseases and max. net profit was obtained by using 2 sprays of carbendazim (0.15%).

The results of the effect of different management practices on percent germination shoot length, root length and vigour index of the harvested okra seeds are presented in the Table 2. The results revealed that the maximum germination percentage (98.00%) was recorded from the seeds of the plants with T_8 [seed treatment with carbendazim (0.1%) + foliar spray of carbendazim (0.15%)] while it was minimum (66.00%) in T_{11} (Control). The performance of T_8 [seed treatment with carbendazim (0.1%) + foliar spray of carbendazim (0.15%)] in respect of percent germination was at par with T_9 [soil amendment with mustard oil cake + foliar spray of carbendazim (0.15%)], T_{10} [soil application of kitchen ash + foliar spray of carbendazim (0.15%)] and T_6 [foliar spray of carbendazim (0.15%)] which was followed by T_4 [seed treatment with carbendazim (0.1%)], T_5 [spraying suspension of BAU-Biofungicide (0.2%)] and T_3 (soil application of kitchen ash), respectively. This experiment shows that after application of different disease management practices, percent germination over control of the harvested seeds increased in every cases and it was ranged from 6.06 to 48.48%.

Table 2. Effect of different management practices on germination, shoot length, root length and vigour index of the harvested okra seeds

Treatment	% Germination	% Germination increase over control	Shoot length (cm)	Root length (cm)	Vigour index
T_1	79.00	19.70	19.39	13.95	2634
T_2	78.00	18.18	18.73	13.71	2530
T_3	70.00	6.06	16.79	12.56	2055
T_4	88.00	33.33	20.55	14.48	3083
T_5	79.00	19.70	17.98	13.64	2498
T_6	96.00	45.45	23.01	15.79	3725
T_7	81.00	22.73	18.91	14.27	2688
T_8	98.00	48.48	23.79	16.12	3911
T_9	97.00	46.96	24.96	16.37	4009
T_{10}	96.00	45.45	23.32	16.01	3776
T_{11}	66.00	-	16.21	12.09	1868
LSD $_{(P=0.05)}$	3.682	-	2.631	2.911	98

The results of the study showed that the range of shoot and root length was measured from 16.79 to 24.96 cm and 12.56 to 16.37 whereas in control it was 16.21 cm and 12.09 cm, respectively. The highest (4009) and lowest (1868) vigour index were noted from the seeds harvested from T_9 [soil amendment with mustard oil cake + foliar spray of carbendazim (0.15%)] and T_{11} (Control), respectively. Sinha *et al.* (2001) investigated the effects of 4 common fungicides, i.e. Dithane M-45 [mancozeb], Bavistin [carbendazim], Agrosan GN (phenylmercury acetate and ethylmercury chloride) and thiram, at 0.1, 0.2 and 0.3% on the seed mycoflora, germination and vigour index of okra cv. Vaishali Vadhu after harvesting and found that all the fungicides were effective in reducing the seed mycoflora and the germination percentage as well as vigour index were higher than that of the untreated control.

References

Abdul-Baki, A.A. and Anderson, J.D. 1973. Vigour determination of Soybean seed by multiple criteria. Crop Sci. 13: 630-633.

Agrawal, R. L. 1995. Seed Technology. Second Edn. Oxford & IBH Pub. Co. Pvt. Ltd. New Delhi. pp. 514-564.

Anam, M.K., Fakir, G. A., Khalequzzaman, K.M., Hoque, M.M. and Rahim, A. 2002. Effect of seed treatment on the

incidence of seed-borne diseases of okra. Pakistan J. Plant Path.. 11(3): 10-14.

Anonymous. 2008. Statistical Bulletin- Bangladesh, Bangladesh Bureau of Statistics, Planning Division, Ministry of Planning, Government of the Peoples Republic of Bangladesh, Dhaka, Bangladesh. p. 67.

Beura , S.K., Mohapatra, K.B., Paul, P.K. and Nandi, A. 2007. Chemical management of Cercospora blight of okra in Orissa. J. Plant Protection and Environment. 4(2): 134-137.

Galletti, S., Cerato, C., Burzi, P.L., Marinello, S., and Stevanato, P. 2004. Trichoderma applications on sugar beet leaves reduce lesion size and sporulation of Cercospora beticola and increase sucrose yield. Bulletin-OILB/SROP. 27(8): 211-214.

Mehrotra, R.S. and Aggarwal, A. 2003. Plant Pathology. Second Edn. Tata McGraw-Hill Pub. Com. Ltd. New Delhi. pp. 606-619.

Rangaswami, G. 1988. Diseases of Crop Plants in India. Third Edn. Prentice-Hall of India Pvt. Ltd. New Delhi. pp. 271-314.

Singh, D., Maheshwari, V.K. and Gupta, A. 2001. Fungicidal control of Cercospora leaf spot in seed crop of okra [Abelmoschus esculentus (L.) Moench.]. Seed-Research. 29(2): 254-256.

Singh, R.S. 1999. Diaeases of Vegetables Crops. Third Edn. Oxford & IBH Pub. Co. Pvt. Ltd. New Delhi. pp. 337-358.

Singh, S.K., Gupta, B., R. and Verma, V.S. 1994. Combined management of anthracnose and Cercospora leaf spots in mungbean. Indian Journal of Mycology and Plant Pathology. 24(2): 139-140.

Sinha, A., Rai, J.P and Singh, H.K. 2001. Seed mycoflora of Okra and its control by fungicides. Progressive Horticulture. 33(1): 84-89.