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Effect of date of sowing and fungicides on Alternaria blight of Indian mustard (*Brassica juncea* (L.) Czern & Coss.)

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Abstract
Among the various causes of biotic diseases namely downy mildew, Alternaria blight, white rust, powdery mildew and wilt are widely prevalent diseases of Indian mustard in Eastern U.P. Alternaria proved most devastating disease in Indian mustard and causes heavy loss in seed yield. To manage the Alternaria blight, a field trial was conducted in 2012-13 and 2013-14. Two test varieties namely Varuna and NDR8501 were sown on 20 October and 10 November and four fungicides namely Mancozeb, Folicur, Quintal and Nativo were used to managing the disease. The minimum interaction effect between date of sowing (1st date of sowing), variety (NDR8501) and fungicide (Folicur) was 2.59 and 4.35 for leaf blight, 0.00 and 0.00 for pod blight, 4.22 and 4.08 for test weight and 1886.18 and 1685.59 for seed yield, respectively in 2012-13 and 2013-2014.

Keywords: Varuna, NDR8501, Folicur, quintal, Nativo

1. Introduction
Rapeseed-mustard is one of the most important *Rabi* oil seed crop, cultivated in India and around the world and contributes a major share to the vegetable fat economy of the country. Rapeseed-mustard having first rank in area and production in India, next to the groundnut both in area and production. Area and production of rapeseed-mustard in India was 64.54 lakh ha and 72.82 lakh tones with average productivity of 1128 kg/ha (Anonymous, 2014). It accounts for nearly 20-22% of the total oilseeds produced in the country. In India, the major rapeseed-mustard growing states are Rajasthan, Uttar Pradesh and Haryana. Uttar Pradesh is the second largest rapeseed-mustard growing state after Rajasthan and contributes 18 per cent to the national acreage and 18.70 per cent to the production. The oil of rapeseed-mustard serves as a very good cooking medium and dietary fat of the majority of population in Northern, North-Western, Central, Eastern and North-Eastern states. Besides oil, the leaves of young plants are used as green vegetables and whole plant as green fodder and sometimes used in bio fumigation. The seeds are highly nutritive containing 37.7-52.9% erucic acid, 8.5-19.0% linoleic acid and 8.6-17.1% oleic acid (Robbelen and Thies, 1980) [12]. Among the various causes of low productivity, diseases are most important ones. This crop suffers from a number of devastating diseases such as Alternaria blight, white rust, downy mildew, powdery mildew, bacterial rot and wilt (Kolte, 1985) [7]. These diseases individually or collectively cause greater loss in productivity. Among these diseases Alternaria blight disease in the beginning is not significant but at a later stage of plant growth, the incidence of the disease becomes very high resulting in considerable yield losses.

Materials and methods
The experiments were carried out in October to March in 2012-13 and 2013-14 at experimental site of the Department of Plant Pathology, Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad. Trials were conducting using split plot design with 5 treatments in 3 replications and with 2 dates of sowing. The field was first deep ploughed and for one week allowing uprooted weeds to die. The recommended plot size (Main-35 m x 8.5 m, Sub-17.5 m x 8.5 m sub-sub-3m x 4m) was used for better crop growth. A basal dose (100:40:40 NPK) of fertilizers was applied. Seeds of two varieties namely Varuna and NDR8501 were sown by hand in rows at 1.5-2.0 kg seed/ha, keeping a row spacing of 45 cm. This crop was sown on 20th October and second crop was sown on 10th

November. The crop was irrigated 3 times as required at different developmental stage. Weeding was done twice, 45 and 75 days after sowing in both crops. The spray schedule including three sprays of each treatment, the first one immediately after the appearance of the disease symptoms while subsequent sprays were repeated at 15 days intervals. The severity of the disease was assessed one week after each spray application using 0-5 scale (Conn. *et al*., 1990) [3]. Ten plants randomly selected and tagged after each treatment application were assessed and the yield of each micro plot was recorded after threshing. The severity of blight from each micro plot was calculated to obtain an average of each replicate. The treatment combinations *i.e.* date of sowing, varieties and fungicides are given below:

Treatments combinations: 20

T_1	-	$D_1V_1F_1$	T_{11}	-	$D_2V_1F_1$
T_2	-	$D_1V_1F_2$	T_{12}	-	$D_2V_1F_2$
T_3	-	$D_1V_1F_3$	T_{13}	-	$D_2V_1F_3$
T_4	-	$D_1V_1F_4$	T_{14}	-	$D_2V_1F_4$
T_5	-	$D_1V_1F_0$	T_{15}	-	$D_2V_1F_0$
T_6	-	$D_1V_2F_1$	T_{16}	-	$D_2V_2F_1$
T_7	-	$D_1V_2F_2$	T_{17}	-	$D_2V_2F_2$
T_8	-	$D_1V_2F_3$	T_{18}	-	$D_2V_2F_3$
T_9	-	$D_1V_2F_4$	T_{19}	-	$D_2V_2F_4$
T_{10}	-	$D_1V_2F_0$	T_{20}	-	$D_2V_2F_0$

Spraying of fungicides

Spraying of fungicides was initiated with the first appearance of disease. Second and third spray was given at 15 day intervals. The required amount of each fungicide was calculated, weighed and spray solution was prepared with water. 1000 litre of water was used for one hectare. Each fungicide was dissolved in small amount of water and then the volume was made upto the desired level and was sprayed by using high volume Knap Sack sprayer of 15 litre capacity. In all the treatments spray was given just after the appearance of the disease. Remaining two subsequent sprays were given at fortnight intervals.

Observations recorded

1. disease Severity
2. Test weight
3. Seed yield per hectare

Processing of data

Per cent Alternaria blight severity was recorded on leaves and pods following 0-5 scale of Conn *et al*. (1990) [3] where 0= Leaves/pods free from infection, 1= Small irregular spots covering 1-10% leaves/pods area, 2= Small irregular brown spots with concentric rings covering 10.1-25% leaves/pods area, 3= Lesions enlarging, irregular brown with concentric rings covering 25.1-50% leaves/pods area, 4= Lesions coalesce to form irregular and appears as a typical blight symptom covering 50.1-75% leaves/pods area and 5= Lesions coalesce to form irregular and appears as a typical symptom covering >75% leaves/pods area.

The per cent disease intensity (PDI) was calculated by using the following formula:

$$\text{PDI} = \frac{\text{Sum of total numerical ratings}}{\text{Total no.of leaves examined x maximum grade}} \times 100$$

Results and discussion

Effect of sowing dates on disease intensity of Alternaria leaf blight, pod blight test weight and seed yield

First date of sowing (20 October) showed less Alternaria leaf blight intensity of 20.44% and pod blight of 12.25% after last spray for the first year and 23.14% and 13.90%, respectively for second year were significantly superior to second date of sowing in 2012-13 and 2013-14. In respect of leaf blight and pod blight severity (24.80 & 15.07%) and (27.11 & 16.99%) were recorded in second date of sowing (10 November) in both the years, respectively. Significantly higher test weight of 3.71g and 3.55g for the first and second year were noted in the first date of sowing as compared to second date of sowing (3.52 & 3.43 g), respectively. The higher seed yield of 1613.20 and 1554.44 kg ha^{-1}, respectively, in first date of sowing were found significantly superior to second date of sowing having seed yield of 1235.83 and 1153.88 kg ha^{-1} in both the years, respectively (Table 1 and 2). The findings were in agreement with the reports of Rahman and Shahjahan (1986) [10], Howlider *et al.* (1989) [5], Mian and Akanda (1989) [9], Meah (1992) [8], Rashid *et al.* (1995) [11] and Khatun *et al*. (2011) [4] who also found that mustard sown in October or before 2 November had lower infections from *A. brassicae* and the infection increased with delay in sowing.

Effect of varieties on disease intensity of Alternaria leaf blight, pod blight test weight and seed yield

NDR8501 showed lower Alternaria leaf blight of 21.87% and pod blight intensity of 21.87%. It gave higher test weight of 3.64 g and seed yield of 1464.97 kg ha^{-1}. It proved, NDR8501significantly superior to Varuna that showed higher leaf blight intensity of 23.36%, pod blight intensity 14.54%, lower test weight of 3.59 g and seed yield of 1385.06 kg ha^{-1} during 2012-13. The same trend was found in the year 2013-14 (Table 1 and 2). Meah (1992) [8] showed 80% reduction in *Alternaria* blight severity and 50% increasing yield when variety Sampad/BINA-3 was sown between 18 October and 2 November. Under the late sowing condition (21 November) BARI Sarisha 11 performed better than all other varieties. This result supported the findings of Khatun and Hossain (2007) [6] who evaluated the variety BARI Sarisha 11 as resistant to Alternaria.

Effect of fungicides on disease intensity of Alternaria leaf blight, pod blight test weight and seed yield

All the sprays of fungicides significantly reduced the severity of Alternaria blight and increased the test weight and seed yield during both the years in comparison to unsprayed check. Lowest Alternaria blight intensity of 3.43%, pod blight of 00.00%, highest test weight of 4.01 g and seed yield of 1615.07 kg ha^{-1} was recorded with the spray of Folicur followed by Nativo having leaf blight of 6.44%, pod blight of 1.22%, test weight of 3.85 g and seed yield of 1494.50 kg ha^{-1} during 2012-13. In the year 2013-14 also lowest leaf blight intensity of 5.09%, pod blight intensity of 00.00%, along with highest test weight of 3.96 g and seed yield of 1495.52 kg ha^{-1} were recorded with Folicur (0.075%) followed by Nativo and Mancozeb respectively. During 2012-13 and 2013-14 the seed yield was at par obtained from all the treatments while during 2012-13 spays of Folicur gave significantly higher seed yield rest of the treatments (Table 1 and 2). Two foliar sprays of Ridomil MZ at 60 and 80 days after sowing reduced the Alternaria blight disease severity from 57.3 to 41.4 percent and increased the yield from 1052 (control) to 1842 kg/ha (Yadav, 2003) [15]. Chattopadhyay *et al*. (2003) [2] and Singh

et al. (2008) [13] also tested seven fungicides for their efficacy against Alternaria leaf blight disease under field conditions. They found that the foliar spray with Iprodione twice at 45 days 60 days after sowing was effective in controlling Alternaria blight disease over check followed by Mancozeb. However, Singh and Singh (2007) [14] reported that foliar spray with Mancozeb was found effective in reducing the disease severity followed by Bavistin and Blitox-50.

Interaction effect of dates of sowing, varieties and fungicides on leaf blight and pod blight intensity

Minimum leaf blight intensities of 2.59 and 4.35% were recorded in first and second year, respectively, with NDR8501 sprayed with Folicur sown on 20 October followed by Varuna, with spray of same fungicide and same date of sowing. Maximum leaf blight intensities of 58.18 and 61.10% in respective years were recorded with unsprayed plots in second date of sowing in variety Varuna (Table 3a and 4a). Minimum pod bight intensities of 00.00 and 00.00% were recorded in first and second years, respectively, were also recorded with spraying of Folicur in first date of sowing with NDR8501 followed by Varuna, with sprays of same fungicide and same date of sowing. Ten November sown crop showed maximum pod blight severity (45.52 and 48.35%) in both the years, respectively with Varuna (unsprayed plots), (Table 3b and 4b). Meah (1992) [8] showed 80% reduction in Alternaria blight severity when variety Sampad/BINA-3 was sown between 18 October and 2 November. Under the late sowing condition (21 November) BARI Sarisha 11 performed better than all other varieties.

Interaction effect of dates of sowing, varieties and fungicides on test weight

NDR8501 sown on 20 October and protected with Folicur have maximum test weight of 4.22 and 4.08 g in 2012-13 and 2013-14, respectively followed by Varuna sown on same date and protected with same fungicide. Minimum test weight of 2.69 and 2.56 g in respective years were noted with unsprayed plots of Varuna sown on 10 November. Interaction effect was noted significant (Table 3c and 4c).

Interaction effect of dates of sowing, varieties and fungicides on seed yield

Maximum seed yield of 1886.18 and 1685.59 kg ha^{-1} were recorded in 2012-13 and 2013-14, respectively, were found most effect with Folicur sprayed at first date of sowing in variety NDR8501 followed by Nativo sprayed at same date of sowing in same variety. Minimum seed yield of 893.74 and 828.20 kg ha^{-1} in respective years, were recorded with untreated plots at second date of sowing in variety Varuna. No significant interaction was recorded among date of sowing x variety x fungicidal spray in case of seed yield (Table 3d and 4d). Meah (1992) [8] showed 50% increasing yield when variety Sampad/BINA-3 was sown between 18 October and 2 November. Under the late sowing condition (21 November) BARI Sarisha 11 performed better than all other varieties.

Table 1: Effect of date of sowing, varieties and fungicides on foliar diseases, test weight and seed yield during 2012-13

Treatments	Alternaria blight (PDI)			Pod	1000-seed weight (g)	Yield (kg/ha)
	After 1st spray	After 2nd spray	After 3rd spray			
Date of sowing						
D_1-20 Oct. 2012	6.99 (15.33)	13.83 (21.83)	20.44 (26.88)	12.25 (20.49)	3.71	1613.20
D_2-10 Nov. 2012	8.22 (16.66)	14.35 (22.26)	24.80 (29.87)	15.07 (22.84)	3.52	1235.83
CD at 5%	0.64	1.11	0.71	0.08	0.07	88.59
Varieties						
V_1- Varuna	8.01 (16.44)	15.93 (23.52)	23.36 (28.90)	14.54 (22.41)	3.59	1384.06
V_2- NDR8501	7.20 (15.57)	12.24 (20.48)	21.87 (27.88)	12.79 (20.95)	3.64	1464.97
CD at 5%	0.82	0.78	0.51	0.20	0.33	0.331
Fungicides						
F_1- Quintal @ 0.2%	6.94 (15.27)	13.60 (21.64)	18.53 (25.50)	8.90 (17.35)	3.58	1488.76
F_2- Folicur @ 0.2%	0.97 (5.64)	2.29 (8.69)	3.43 (10.67)	0.00 (00.00)	4.01	1615.07
F_3- Mancozeb @ 0.25%	10.26 (18.68)	20.05 (26.60)	23.02 (28.65)	19.93 (26.51)	3.83	1466.96
F_4- Nativo @ 0.05%	2.62 (9.31)	4.36 (12.05)	6.44 (14.69)	1.22 (6.33)	3.85	1494.50
F_0-Unsprayed (control)	17.25 (24.54)	30.15 (33.30)	51.96 (46.12)	38.27 (38.21)	3.02	1057.30
CD at 5%	0.79	0.93	0.79	0.74	0.735	0.735

Table 2: Effect of date of sowing, varieties and fungicides on foliar diseases, test weight and seed yield during 2013-14

Treatments	Alternaria blight (PDI)			Pod	1000-seed weight (g)	Yield (kg/ha)
	After 1st spray	After 2nd spray	After 3rd spray			
Date of sowing						
D_1-20 Oct. 2013	9.14 (17.60)	15.98 (23.56)	23.14 (28.75)	13.90 (21.89)	3.55	1554.44
D_2-10 Nov. 2013	10.51 (18.91)	18.91 (25.77)	27.11 (31.38)	16.99 (24.34)	3.43	1153.88
CD at 5%	0.51	1.16	0.81	0.37	0.22	92.21
Varieties						
V_1- Varuna	10.37 (18.78)	18.12 (25.19)	25.97 (30.64)	16.34 (23.84)	3.46	1333.32
V_2- NDR-8501	9.28 (17.74)	16.77 (24.17)	24.28 (29.52)	14.55 (22.42)	3.53	1375.00
CD at 5%	0.91	0.51	0.39	0.24	0.39	11.55
Fungicides						
F_1- Quintal @ 0.2%	9.13 (17.58)	15.86 (23.47)	21.08 (27.33)	11.18 (19.53)	3.37	1364.86
F_2- Folicur @ 0.2%	2.45 (9.01)	4.04 (11.59)	5.09 (13.04)	0.00 (0.00)	3.96	1495.52
F_3- Mancozeb @ 0.25%	13.26 (21.35)	22.78 (28.51)	35.35 (36.48)	22.16 (28.08)	3.67	1400.17
F_4- Nativo @ 0.05%	4.51 (12.25)	6.61 (14.90)	8.73 (17.19)	2.55 (9.19)	3.81	1428.17
F_0-Unsprayed (control)	19.78 (26.41)	37.94 (38.02)	55.37 (48.08)	41.32 (40.00)	2.66	1082.07
CD at 5%	0.99	0.80	0.77	0.79	0.82	28.95

Table 3: Interaction effect of date of sowing, varieties and fungicides on disease intensity, test weight and seed yield in 2012-13

(a) Alternaria leaf blight, after 3rd spray						
DVF		**F_1**	**F_2**	**F_3**	**F_4**	**F_0**
D1	V1	17.92 (25.04)	2.78 (9.60)	30.98 (33.82)	6.00 (14.18)	48.41 (44.09)
	V2	15.87 (23.48)	2.59 (9.26)	29.10 (32.65)	5.46 (13.51)	45.25 (42.27)
D2	V1	20.65 (27.03)	4.85 (12.72)	35.87 (36.79)	8.16 (16.60)	58.18 (49.71)
	V2	19.69 (26.34)	3.48 (10.75)	34.96 (36.25)	6.12 (14.32)	56.01 (48.45)
SEm± 0.51				CD at 5%1.61		

(b) Pod						
DVF		**F_1**	**F_2**	**F_3**	**F_4**	**F_0**
D1	V1	9.26 (17.72)	0.00 (0.00)	17.92 (25.04)	1.02 (5.80)	36.19 (36.98)
	V2	7.52 (15.92)	0.00 (0.00)	16.05 (23.62)	1.00 (5.74)	33.58 (35.41)
D2	V1	10.19 (18.62)	0.00 (0.00)	23.58 (29.05)	1.67 (7.43)	45.52 (42.43)
	V2	8.62 (17.07)	0.00 (0.00)	22.16 (28.08)	1.17 (6.21)	37.77 (37.92)
SEm± 0.44				CD at 5% 1.34		

(c) Test weight						
DVF		**F_1**	**F_2**	**F_3**	**F_4**	**F_0**
D1	V1	3.61	4.10	3.81	3.94	2.82
	V2	3.72	4.22	3.93	4.00	2.94
D2	V1	3.48	3.98	3.68	3.83	2.69
	V2	3.52	4.00	3.73	3.87	2.81
SEm± 0.43				CD at 5% 1.35		

(d) Seed Yield						
DVF		**F_1**	**F_2**	**F_3**	**F_4**	**F_0**
D1	V1	1636.49	1793.58	1649.53	1673.97	1270.65
	V2	1727.19	1886.18	1720.35	1784.54	1348.18
D2	V1	1225.69	1345.16	1260.62	1322.31	893.74
	V2	1278.45	1435.34	1324.53	1345.16	927.25
SEm± 0.71.91				CD at 5% 218.74		

D_1= 20th October, D_2= 10 November, V_1= Varuna, V_2= NDR8501, F_1= Quintal, F_2= Folicur, F_3= Mancozeb, F_4= Nativo, F_0= Unsprayed (control)

Table 4: Interaction effect of date of sowing, varieties and fungicides on disease intensity, test weight and seed yield 2013-14

(a) Alternaria leaf blight, after 3rd spray						
DV F		**F_1**	**F_2**	**F_3**	**F_4**	**F_0**
D1	V1	20.62 (27.00)	4.51 (12.26)	34.00 (35.67)	8.63 (17.08)	52.24 (46.28)
	V2	18.68 (25.61)	4.35 (12.04)	31.20 (33.96)	7.37 (15.75)	49.82 (44.90)
D2	V1	23.57 (29.04)	6.12 (14.32)	39.08 (38.69)	10.00 (18.43)	61.10 (51.41)
	V2	21.47 (27.60)	5.39 (13.42)	37.11 (37.53)	8.93 (17.39)	58.32 (49.79)
SEm± 0.54				CD at 5%1.59		

(b) Pod						
DVF		**F_1**	**F_2**	**F_3**	**F_4**	**F_0**
D1	V1	11.01 (19.38)	0.00 (0.00)	20.05 (26.60)	2.10 (8.33)	39.79 (39.11)
	V2	9.51 (17.96)	0.00 (0.00)	18.13 (25.20)	2.20 (8.53)	36.18 (36.98)
D2	V1	12.39 (20.61)	0.00 (0.00)	26.47 (30.96)	3.21 (10.32)	48.35 (44.05)
	V2	11.81 (20.10)	0.00 (0.00)	24.00 (29.33)	2.70 (9.46)	40.97 (39.80)
SEm± 0.49				CD at 5%1.46		

(c) Test weight						
DVF		**F_1**	**F_2**	**F_3**	**F_4**	**F_0**
D1	V1	3.37	3.98	3.68	3.84	2.68
	V2	3.49	4.08	3.72	3.90	2.77
D2	V1	3.29	3.86	3.59	3.71	2.56
	V2	3.32	3.90	3.67	3.79	2.63
SEm± 0.51				CD at 5%1.53		

(d) Seed yield					
DVF	**F_1**	**F_2**	**F_3**	**F_4**	**F_0**
V1	1572.47	1670.58	1588.31	1600.00	1116.48
V2	1578.45	1685.59	1608.20	1621.94	1243.72
V1	1115.38	1296.43	1175.96	1215.19	828.20
V2	1193.15	1329.47	1228.19	1275.55	881.25
SEm±72.38			CD at 5% 223.16		

D_1= 20th October, D_2= 10 November, V_1= Varuna, V_2= NDR8501, F_1= Quintal, F_2= Folicur, F_3= Mancozeb, F_4= Nativo, F_0= Unsprayed (control)

References

1. Anonymous. Economic Survey of India. Govt. of India, Economics and Statistics, Ministry of Agriculture (Department of Agriculture and Cooperation), New Delhi, 2014.
2. Chattopadhyay AK, Bhunia CK. Management of Alternaria blight of rapeseed-mustard by chemicals. J. Mycopathol. Res. 2003; 41(2):181-183.
3. Conn KL, Tewari JP, Awasthi RP. A disease assessment key far Alternaria black spot in rapeseed and mustard. Can. Pl. Dis. Surv. 1990; 70:19-22.
4. Khatun F, Alam MS, Hossain MA, Malaker PK, Rashid MH. Effect of sowing dates and varieties on the severity of Alternaria blight of mustard. Bangladesh J Agril. Res. 2011; 36(4):583-594.
5. Howlider MAR, Meah MB, Ara KA, Begum M, Rahman A. Effect of date of sowing on leaf and pod blight severity and yield of mustard. Bangladesh J.Pl. Path. 1989; 5(1, 2):41-45.
6. Khatun F, Hossain MA. Integrated management of Alternaria leaf blight of mustard. Krishikatha, Krishi Tathya Services, Khamarbari, Dhaka. 2007; 66(10):297-298.
7. Kolte SJ. Diseases of annual edible oilseed crops. Rapeseed-Mustard and Sesame diseases. CRC Press. Inc. Boca Ratan, Florida, 1985, 135.
8. Meah MB. Alternaria blight of mustard: model for integrated control. Papepresented in the National Workshop on Oilseed Research and Development in Bangladesh, 26-29 April 1992 at BARC, Dhaka. 1992, 1-21.
9. Mian IH, Akanda AM. Effect of sowing time, irrigation, soil moisture and nutrient status on Alternaria blight of mustard. Bangladesh J. Pl. Pathol. 1989; 5(1, 2):77-80.
10. Rahman MS, Shahjahan AKM. Effect of dates of sowing on the yield and yield contributing characters of some selected mustard varieties/mutants. Bangladesh Association for the advancement of Science, Dhaka. Proc. of the 11th Ann. Bangladesh Sci. Conf. BAAS. 1986, 58-59.
11. Rashid MM, Meah MB, Meah A, Hossain MS, Ahmed A. Effect of sowing date and Rovral in controlling Alternariablight of mustard. Prog. Agric. 1995; 6(2):41-47.
12. Robbelen G, Thies W. Biosynthesis of seed oil and breeding for improved oil quality of rapeseed. Brassica crops and wild allies, Japan Scientific Societies Press, Tokyo. 1980, 153-283.
13. Singh N, Narain U, Gupta SK, Hussain F, Mathuria OP. Epidemiological studies on Alternaria blight of linseed. Ann. Pl. Protec. Sci. 2008; 16(1):252-253.
14. Singh R, Singh VK. Evaluation of fungicides against Alternaria blight of *Brassica campestris*. Ann. Pl. Protec. Sci. 2007; 15(1):266-267.
15. Yadav MS. Efficacy of fungitoxicants in the management of Alternaria blight and white rust of mustard. J Mycol. Pl. Pathol. 2003; 33(2):307-309.