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EFFECT OF SOWING DATES AND VARIETIES ON STEMPHYLIUM BLIGHT OF LENTIL

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Abstract

A research work was carried out with a view to evaluate lentil (*Lens culinaris*) varieties at different sowing dates from October 25 to December 6 against *Stemphylium botryosum* in Bangladesh during winter season of 2012-2013.Two lentil varieties *viz*., BARI Masur-1 and BARI Masur-7 were evaluated at seven different sowing dates *viz*., October 25, November 1, November 8, November 15, November 22, November 29 and December 6 in RCB design with three replications. Significant differences were found in percent disease incidence for sowing dates and varieties. The highest disease incidence (72.50%) was recorded from the plants grown from October 25 sowing which was statistically identical to that of November 1 (63.5%), November 15 (62.17%) and November 22 (62.17%). However, disease incidence was drastically reduced at November 29 (42.17%) and December 6 (30.83%) sowings. The variety BARI Masur-1 was found more sensitive (64.0%) to that of BARI Masur-7 (47.0%) to stemphylium disease. The average highest seed yield was obtained from November 8 sowing (1200 kg ha^{-1}) which was statistically identical to that of November 15 sowing (1156 kg ha^{-1}). Between two varieties, BARI Masur-7 was more productive (1131 kg ha^{-1}) than that of BARI Masur-1 (789 kg ha^{-1}). The maximum seed yield ha^{-1} (1399 kg) was achieved from BARI Masur-7 when grown from November 8 sowing followed by November 15 sowing (1314 kg ha^{-1}) by the same variety indicating first fortnight of November might be more productive for BARI Masur-7.

***Keywords*:** Lentil, *Lens culinaris*, Stemphylium blight, sowing dates.

Introduction

Lentil (*Lens culinaris*) is the second most important pulse crop in Bangladesh in terms of both area and production (KD, 2016). Among the factors responsible for low yield of lentil, diseases are considered to be the most serious one. Globally lentil is susceptible to more than 35 diseases (Wikipedia, 2016). So far, 15 pathogens causing 17 diseases have been recorded in Bangladesh, among them stemphylium blight caused by *Stemphylium botryosum* is considered as the most devastating one (Rashid *et al*., 2007).

Early sowing of lentil resulted in more vegetative growth and crops prone to lodging, increasing the risk of disease infection and subsequent poor grain quality. Later sowings reduce disease risk but can result in lower yields due to the risk of dry conditions with high temperatures at flowering and pod filling stages (Hawthorne *et al*., 2016). Potential increase in lentil yield was found by changing sowing date in Ethiopia (Ghanem *et al*., 2015). Early sowing can increase the yield of lentils (Wang *et al*., 2013). In northern India, Singh and Saxena (1982) obtained the highest yield from lentil sown in the first fortnight of November, while later sowing resulted in lower yield. Sinha and Singh (1991) reported that early appearance of stemphylium blight caused alarming yield loss in lentil. It is reflected from the study that yield gradually reduced and PDI increased with delayed sowing (after second week of November). This is probably because of the change in environmental condition, which might be congenial for disease development.

Few bench mark research on stemphylium blight have been carried out in Bangladesh. To ensure profitable cultivation of lentil, the prime importance has to be given for effective management strategy for the disease. Therefore, the present study was done to determine management practices for disease control by changing sowing dates.

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Materials and Methods

The experiment was conducted at the research field of Plant Pathology Division, Regional Agricultural Research Station (RARS), Bangladesh Agricultural Research Institute, Rahmatpur, Barisal during 2012-2013 cropping season. Susceptible variety BARI Masur-1 and moderately resistant variety BARI Masur-7 were used in this investigation. The experiment was conducted in a Randomized Complete Block Design (RCBD) with two factors and three replications. The unit plot size was 5 m × 3 m with spacing 30 cm × 10 cm. Seeds were sown in seven different dates started from 25 October to 6 December 2012 at the rate of 30 kg ha^{-1}. Intercultural operations were done in order to maintain the normal hygienic condition of crop growth. Weeding was done twice at 20 and 35 days after sowing for all sowing dates. Light irrigation was provided after each weeding and excess water was drained out immediately to save the crop from stagnant water.

After completion of the sowing, the experiment was kept under constant observation from sowing to harvest. Data were recorded on days to first flowering, days to maturity, plant height (cm), number of branches $plant^{-1}$, number of pods $plant^{-1}$, yield (kg ha^{-1}), disease incidence and diseases severity. Diseases incidence and diseases severity were recorded following the procedure.

Diseases Incidence: The percent disease incidence of lentil was calculated by the following formula: $\text{Incidence (\%)} = \frac{\text{Number of infected plants}}{\text{Total number of plants counted}} \times 100$

Disease severity scale	Disease reaction
Disease severity data was recorded described below on the basis of 0-5 scoring scale adopted from Bakr *et al*. (2000).	
0 = no infection	0 = Highly Resistant
1 = few scattered leaf infections but no twig blighted	1 = Resistant
2 = 5-10% leaflets infected and/or few scattered twigs blighted	2 = Moderately Resistant
3 = 11-20% leaflets infected and/or 1-5% twigs blighted	3 = Moderately Susceptible
4 = 21-50% leaflets infected and/or 6-10% twigs blighted	4 = Susceptible
5 = ≧ 51% leaflets infected and/or ≧11% twigs blighted.	5 = Highly Susceptible

The collected data from the study were analyzed statistically by using MSTAT-C computer package program. Mean comparisons for treatment were compared using Duncan's Multiple Range Test (DMRT) at 5% or 1% level of significance.

Results and Discussion

Effect of seven different sowing dates and performance of two varieties of BARI Masur-1 and BARI Masur-7 were evaluated against stemphylium blight in 2012-2013. The percent disease incidence of stemphylium blight of lentil is presented in Table 1. Significant difference was found in percent disease incidence at different dates of sowing. Considering seven sowing dates, the highest percent disease incidence was found in October 25 (72.50%) which was statistically similar with those of November 1 (63.5%), November 15 (62.17%) and November 22 (62.17%). The lowest percent disease incidence was observed in December 6 (30.83%) which statistically similar with November 29 but significantly differed with other sowing dates. In case of varietal performance susceptible variety BARI Masur-1 showed 64% disease incidence. On the other hand, BARI Masur-7 recorded 47% disease incidence (Table 2). The disease severity of stemphylium blight of lentil is presented in Table 1. Wide variation was observed in disease severity at seven different dates of sowing in both varieties of lentil. The data were recorded 0-5 scoring scale. Disease severity of stemphylium blight was decreased gradually from early sowing to late sowing of lentil. In early sowing, disease was graded as 4 and 3 scoring scale at October 25 and November 1, respectively. Disease severity was graded as 2 scoring scale at November 8, 15 and 22 sowing plots. In late sowing, November 29 and December 6, disease was graded as 1 scoring scale. In case of varietal performance susceptible variety BARI Masur-1 was graded as 5 scoring scale. On the other hand, BARI Masur-7 was graded as 2 scoring scale (Table 2). Considering two varieties, out of seven sowing dates susceptible (S) and moderately susceptible (MS) diseases reaction was found at October 25 and November 1, respectively. Moderately resistant (MR) diseases reaction was found in November 8, 15, 22 and resistant (R) diseases reaction was found in November 29 and December 6.

Table 1. Effect of different dates of sowing on disease incidence, disease severity and disease reaction of stemphylium blight of lentil in 2012-2013

Sowing dates	Disease Incidence (%)	Disease Severity (0-5)	Disease Reaction
25-10-2012	72.50 a	4	S
01-11-2012	63.50 a	3	MS
08-11-2012	55.67 ab	2	MR
15-11-2012	62.17 a	2	MR
22-11-2012	62.17 a	2	MR
29-11-2012	42.17 bc	1	R
06-12-2012	30.83 c	1	R
Level of significance	**	-	-
CV (%)	25.26	-	-

Means followed the same letter/letters do not statistically differ at 1% level tested by DMRT
** = Significant at 1% level of probability

In case of varietal performance over the all sowing dates individual susceptible variety BARI Masur-1 showed highly susceptible (HS) disease reaction. On the other hand, BARI Masur-7 showed moderately resistant (MR) reaction (Table 2).

Table 2. Varietal performances of lentil on disease incidence, disease severity and disease reaction of stemphylium blight in 2012-2013

Variety	Disease Incidence (%)	Disease Severity (0-5)	Disease Reaction
BARI Masur-1	64 a	5	HS
BARI Masur-7	47 b	2	MR
Level of Significance	**	-	-
CV (%)	25.26	-	-

** = Significant at 1% level of probability

Effects of growth and yield contributing characters are presented in Table 3. Among the seven sowing dates, first flower initiation was found earlier in the December 6 sowing. First flower initiation was found late in the November 8 sowing which was significantly differed from November 15, October 25 and November 1 sowings. Maturity of the plant significantly differed among the treatments and that ranged from 87 to 118 days. Level of maturity was delayed October 25 and gradually decreased the maturity to November 1, 8, 15, 22 and 29 sowing dates. The lowest maturity level was recorded in December 6. The plant height differed significantly among the treatments and ranged from 36.00 cm to 47.37 cm. The tallest plant was recorded in November 1 sowing followed by November 8, 22, October 25, November 15 sowing. Dwarf plant was recorded in December 6 followed by November 29. The number of branches plant^{-1} differed significantly due to different dates of sowing. The number of branches plant^{-1} ranged from 2.43 to 3.27. The highest number of branches plant^{-1} (3.27) was produced at November 15 sowing which was statistically similar with November 8 sowing. The lowest number of branches plant^{-1} was produced at December 6 sowing (2.43) followed by November 1, 22, 29 and October 25 sowing. Number of pods plant^{-1} differed significantly with each other at different dates of sowing. The highest number of pods plant^{-1} (101) was obtained from the November 8 sowing which was statistically similar with November 15. The lowest number of pods plant^{-1} (53) was obtained from December 6 followed by November 29 and 22. The yield plot^{-1} exhibited that November 8 sowing (1200 kg ha^{-1}) gave the highest yield which was statistically similar with November 15 (1200 kg ha^{-1}). Yield was decreased during early or late sowing. The lowest yield was produced in December 6 sowing (766 kg ha^{-1}) followed by October 25, November 29 and November 1.

Table 3. Effects of sowing dates on growth and pod yield of lentil

Sowing dates	Days to first flowering	Days to maturity	Plant height (cm)	Number of branches plant^{-1}	Number of pods plant^{-1}	Yield (kg ha^{-1})
25-10-2012	53 b	118 a	42.80 ab	2.83 ab	74 bc	887 b-d
01-11-2012	52 b	112 b	47.37 a	2.70 ab	83 b	920 bc
08-11-2012	55 a	105 c	47.00 a	3.13 a	101 a	1200 a
15-11-2012	53 b	103 d	42.72 ab	3.27 a	100 a	1156 a
22-11-2012	50 c	96 e	44.85 a	2.67 ab	66 cd	968 b
29-11-2012	48 d	93 f	40.00 bc	2.73 ab	61 cd	824 cd
06-12-2012	46 e	87 g	36.00 c	2.43 b	53 d	766 d
Level of significance	**	**	**	*	*	**
CV(%)	2.16	1.24	8.56	16.81	16.03	10.16

Means followed by same letter/letters do not statistically differ at 1% and 5% level tested by DMRT, * = Significant at 5% level of probability, ** = Significant at 1% level of probability

In case of varietal performance BARI Masur-1 showed first flower initiation earlier compare to popular variety BARI Masur-7 (Table 4). In case of days to maturity both the variety matured in same time. In plant height BARI Masur-7 showed relatively dwarf compare to BARI Masur-1. The highest number of branch plant^{-1} was found in BARI Masur-7 and the lowest was found in BARI Masur-1. BARI Masur-7 produced higher number of pods compare to BARI Masur-1. BARI Masur-7 produced higher yield (1131 kg ha^{-1}) compared to BARI Masur-1 (789 kg ha^{-1}) (Table 4).

Table 4: Effects of varieties on growth and pod yield of lentil

Variety	Days to first flowering	Days to maturity	Plant height (cm)	Number of branches plant^{-1}	Number of pods plant^{-1}	Yield (kg ha^{-1})
BARI Masur-1	49 b	102 a	44 a	2.65 b	74 b	789 b
BARI Masur-7	52 a	101 b	42 b	2.99 a	79 a	1131 a
Level of significance	**	*	*	*	*	**
CV (%)	2.16	1.24	8.56	16.81	16.03	10.16

* = Significant at 5% level of probability, ** = Significant at 1% level of probability

The interaction effect between sowing dates and varieties are presented in Table 5 and Table 6. Significant differences were found among the interaction effect between sowing date and variety for days to first flowering, days to maturity, plant height, number of branches plant^{-1}, number of pods plant^{-1} and yield. It was observed that November 8 and November 15 sowing produced better results in case of variety BARI Masur-7 but in case of variety BARI Masur-1 produced better results in November 8 sowing. Days to first flowering ranged from 42 - 56 days. The highest days to first flowering was observed in BARI Masur-7 at November 8 sowing. The lowest days to first flowering was observed in BARI Masur-1 at December 6 sowing. Maturity of the plant occurred significantly among the treatments and that ranged from 86 - 119 days. The highest days to maturity was found in BARI Masur-7 at October 25. The lowest maturity was recorded in BARI Masur-1 at December 6 sowing that was statistically similar in BARI Masur-7 at same sowing dates.

Table 5. Interaction of sowing dates and varieties on days to first flowering and days to maturity of lentil in 2012-2013

Sowing dates	Variety	Days to first flowering	Days to maturity
25-10-2012	BARI Masur-1	53 bc	116 b
	BARI Masur-7	53 b-d	119 a
01-11-2012	BARI Masur-1	51 c-e	111 c
	BARI Masur-7	53 b-d	113 c
08-11-2012	BARI Masur-1	54 b	106 d
	BARI Masur-7	56 a	104 e
15-11-2012	BARI Masur-1	52 b-d	103 e
	BARI Masur-7	53 bc	102 e
22-11-2012	BARI Masur-1	48 f	95 f
	BARI Masur-7	51 c-e	96 f
29-11-2012	BARI Masur-1	45 g	96 f
	BARI Masur-7	51 de	91 g
06-12-2012	BARI Masur-1	42 h	86 h
	BARI Masur-7	50 ef	88 h
Level of significance		*	*
CV (%)		2.16	1.24

Means followed by same letter/letters do not statistically differ at 5% level tested by DMRT
* = Significant at 5% level of probability

The plant height differed significantly among the treatments and that ranged from 35.13 cm to 49.87 cm (Table 6). The tallest plant was recorded in BARI Masur-1 at November 8 sowing which was statistically similar with October 25 (43.20 cm), November 1 (49.00 cm), 15 (43.67 cm) and November 22 (48.37 cm) sowing in case of BARI Masur-1 and November 1 and 8 in case of BARI Masur-7. The dwarf plant was recorded in BARI Masur-7 at December 6 followed by November 15, 22 and 29 in case of BARI Masur-7 and December 6 and November 29 sowing in case of BARI Masur-1. The number of branches plant^{-1} differed significantly due to different date of sowing. The number of branch plant^{-1} ranged from 2.23 to 3.57. The highest number of branches plant^{-1} was produced in BARI Masur-7 at November 15 sowing which was statistically identical with October 25, November 1, 8 and 22 in BARI Masur-7 variety and October 25, November 8, 15 sowing in BARI Masur-1. The lowest number of branches plant^{-1} was produced in BARI Masur-1 at November 29 followed by October 25, November 8, 15 sowing in BARI Masur-1 and October 25, November 1, 8, 22 and December 6 sowing in BARI Masur-7. Number of pods plant^{-1} differed significantly with each other at different dates of sowing. The highest number of pods plant^{-1} was obtained in BARI Masur-7 in November 8 sowing (108) which were statistically similar with November 1, 8 and 15 in BARI Masur-7 and November 8 and 15 in BARI Masur-1. The lowest number of pod was obtained in BARI Masur-1 at November 29 sowing (50) that were statistically identical with October 25, November 22 and December 6 in BARI Masur-1 and November 22, 29 and December 6 in BARI Masur-7. The highest yield exhibited in BARI Masur-7 variety at November 8 sowing (1399 kg ha^{-1}) which was statistically similar with November 15 sowing (1314 kg ha^{-1}) in BARI Masur-7. Yield was decreased during early or late sowing. The lowest yield was found in BARI Masur-1 at December 6 sowing (583 kg ha^{-1}) followed by November 29, October 25 and November 1 sowing in BARI Masur-1 variety.

Table 6. Interaction of sowing dates and varieties on plant height, number of branches plant^{-1}, number of pods plant^{-1} and yield in 2012-2013

Sowing dates	Variety	Plant height (cm)	No. of branch plant^{-1}	No. of pod plant^{-1}	Yield (kg ha^{-1})
25-10-2012	BARI Masur-1	43.20 a-e	2.97 a-c	70 cd	750 ef
	BARI Masur-7	42.40 b-e	2.70 a-c	78 bc	1023 bc
01-11-2012	BARI Masur-1	49.00 ab	2.57 bc	79 bc	734 ef
	BARI Masur-7	45.73 a-d	2.83 a-c	87 a-c	1105 bc
08-11-2012	BARI Masur-1	49.87 a	3.10 a-c	94 ab	1001 bc
	BARI Masur-7	44.13 a-d	3.17 a-c	108 a	1399 a
15-11-2012	BARI Masur-1	43.67 a-e	2.97 a-c	103 a	997 bc
	BARI Masur-7	41.77 c-f	3.57 a	96 ab	1314 a
22-11-2012	BARI Masur-1	48.37 a-c	2.30 bc	67 cd	792 de
	BARI Masur-7	41.33 c-f	3.03 a-c	64 cd	1145 b
29-11-2012	BARI Masur-1	39.33 d-f	2.23 c	50 d	667 ef
	BARI Masur-7	40.67 d-f	3.23 ab	71 cd	981 bc
06-12-2012	BARI Masur-1	36.87 ef	2.43 bc	54 d	583 f
	BARI Masur-7	35.13 f	2.43 bc	51 d	948 cd
Level of significance		*	*	*	**
CV (%)		8.56	16.81	16.03	10.16

Means followed by same letter/letters do not statistically differ at 1% and 5% level tested by DMRT, * = Significant at 5% level of probability, ** = Significant at 1% level of probability

During last three decades stemphylium blight of lentil caused by S*temphylium botryosum* have emerged as devastating pathogen in Bangladesh. It is considered prime limiting factor in lentil production in our country causing huge economic losses and threatening lentil production. Time of sowing had marked effect upon level of disease incidence and thus manipulating the sowing time infection may be avoided. Many field crops can escape various diseases with the shifting of sowing time. Optimum time of sowing is the important factor for profitable lentil cultivation. During the investigation, in early sowing (October 25 and November 1) plot yield were produced lower due to higher disease severity and in this time vegetative growth was resulting delayed maturity. Optimum sowing (November 8 and November 15) produced higher yield. During late sowing (November 29 and December 6) disease incidence and severity were recorded lower as well as lower yield. Due to late sowing maturity might be forced. In that aspect late sowing having forced maturity might be a cause of yield loss.

These finding was closely favored with Hawthorne *et al*. (2016) who obtained that early sowing of lentil resulted in more vegetative growth and crops prone to lodging, increasing the risk of disease infection and subsequent poor grain quality. Later sowings reduce disease risk but can result in lower yields due to the risk of dry conditions, high temperatures at flowering and pod filling stage. Many previous researchers supported that incidence and severity of disease were varied by changing the sowing time resulting the effect on yield. Ahmed *et al*. (2002) reported that sowing date of lentil is considered as one limiting factor for disease incidence in field. Jain *et al*. (1987) confirmed that effect of sowing date on yield of lentil on November 1 showed significantly the lowest PDI and the highest yield followed by November 10 and November 20. Sowing on early November could avoid disease significantly and increase yield. Before few years, in the same location (Barisal) of the present investigation, Huq and Khan (2008) conducted an experiment and found similarity of the result with some extents that was effect of sowing date on yield of lentil on November 1 showed significantly the lowest PDI and the highest yield followed by November 10 and November 20.

Conclusion

Sowing on early November in Barisal region of Bangladesh could avoid stemphylium blight disease significantly and increased yield of lentil. It might be concluded that optimum sowing time of lentil was November 8 to 15 in Bangladesh condition to minimize stemphylium blight and increase the yield. So it might be recommended that lentil may be sown before November 20 for maximum yield by reducing stemphylium blight severity.

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