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## Effect of sowing date and seed rate on yield performance of two mustard varieties

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### Abstract

An experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during the period from November 2007 to March 2008 to study the effect of sowing date and seed rate on the yield and yield components of two mustard varieties. The treatments included two varieties viz. BARI Sarisha-9 and BARI Sarisha-6; three sowing date viz. 10, 20 and 30 November, and three seed rates viz. 8, 10 and 12 kg seeds ha<sup>-1</sup>. The experiment was laid out in a split plot design with three replications. It was observed that the variety had significant influence on the yield and yield contributing characters except non-effective pods plant<sup>-1</sup>, non-effective seeds pod<sup>-1</sup> and 1000-seed weight. Higher seed yield was obtained by the variety BARI Sarisha-9. The highest seed yield (1.53 t ha<sup>-1</sup>) was recorded in 10 November sowing and the lowest one was achieved in 30 November sowing. Seed rate had also significant effect on plant height, branches plant<sup>-1</sup>, pods plant<sup>-1</sup>, effective pods plant<sup>-1</sup>, pod length, no. of seeds pod<sup>-1</sup> and seed yield. The seed rate 8 kg ha<sup>-1</sup> produced the highest seed yield (1.49 t ha<sup>-1</sup>) and the lowest seed yield was produced by 12 kg seeds ha<sup>-1</sup>. Among the yield contributing characters only harvest index and non-effective pods plant<sup>-1</sup> were significantly influenced by the interaction of variety and date of seeding as well as the interaction of variety and seed rate. The highest seed yield (1.63 t ha<sup>-1</sup>) was produced when BARI Sarisha-9 was sown on 10 November. In case of interaction between variety and seed rate, BARI Sarisha-9 with 10 kg seeds ha<sup>-1</sup> produced the maximum seed yield. Results further showed that the interaction of 10 November sowing with 8 kg seeds ha<sup>-1</sup> produced the highest seed yield (1.55 t ha<sup>-1</sup>).

**Keywords:** Mustard, Variety, Date of Seeding, Seed Rate, Seed Yield

### Introduction

In Bangladesh context, mustard (*Brassica spp.*) is a popular edible oil in rural area and is considered important for improving the taste of a number of food items. It also serves as an important raw material for industrial use such as in soap, paints, varnishes, hair oils, lubricants, textile auxiliaries, pharmaceuticals, etc. The oil is also used by villagers for hair dressing and massage of the bodies before bath. Oil cakes (contains 40% protein) and meals are used as animal feeds and manures. Plant parts are used as fuel. Mustard oils have several medicinal uses. If it is rubbed all over the body of a baby or an adult followed by sun bathing for one hour or so, a good amount of vitamin D is synthesized in the body which is essential for bone formation. In Ayurvedic medicine, it is believed that mustard oil boiled with few cloves of garlic can cure some forms of influenza (Khaleque, 1985). Moreover, mustard can give Tk.6,000 more income per hectare than *boro* rice (Wahhab *et al.*, 2002). It has an excellent export potential and it is a labour intensive crop.

The analysis of the productivity trend reveals that mustard yield in Bangladesh has increased from 672 kg ha<sup>-1</sup> to 757 kg ha<sup>-1</sup> for the last decade with the annual growth rate of only 1.26% (Rahman, 2002). This is alarmingly poor compared to that of advanced countries like Algeria, Germany, France, UK and Poland producing 6667 kg, 3507 kg, 3264 kg, 3076 kg and 2076 kg ha<sup>-1</sup>, respectively (FAO, 2001). The major reasons for low yield in our country are lack of use of both high yielding varieties and appropriate technologies.

Yield and its formation process depend on genetic, environmental and agronomic factors as well as the interaction between them (Sidlauskas and Bernotas, 2003). Therefore, there is a scope to increase the yield level of mustard by using HYV seed and by adopting proper management practices such as date of seeding, seed rate, irrigation, fertilizer application and other cultural operations. Optimum seed rate plays an important role in producing higher yield. Establishment of optimum plant density per unit area is a prerequisite for having increased seed yield. The plant density can be adjusted by the use of different seed rates and row spacing. Seed rate thus influences yield and yield contributing characters of mustard (Johnson *et al.*, 2001).

Seed yield of mustard declined gradually by 11.7, 21.5, 43.4 and 62.9%, respectively, for each week delay after 1 November sowing (Rahman *et al.*, 1993). Yield reduction due to late sowing is of common occurrence owing to low level of dry matter accumulation accompanied by pod abortion and decrease in seed set.

Keeping in view the inter-plant competition for optimum plant nutrients, sun light, moisture and aeration, it may be required to find out a fair combination of date of sowing and seed rate to achieve maximum yield of mustard. Hence, the present study was undertaken with two important mustard varieties, BARI Sarisha-6 and BARI Sarisha-9 to find out their appropriate seed rate, date of seeding and various interactions involved among variety, date of seeding and seed rate for better growth and yield.

## Materials and Methods

An experiment was conducted at the Agronomy Field Laboratory of Bangladesh Agricultural University during the *Rabi* season. Two varieties of mustard BARI Sarisha-9 and BARI Sarisha-6 were taken as experimental crop. The experimental treatments were 3 sowing dates viz. 10, 20 and 30 November, and 3 seed rates viz. 8, 10 and 12 kg seeds ha<sup>-1</sup>. The experiment was laid out in a split plot design assigning variety in the main plot, date of seeding in the sub-plot and seed rate in the sub-sub plot with 3 replications. The unit plot size was 4.0m × 2.5m. Seed were sown in properly prepared land. Recommended fertilizers were used at the rate of 250, 180, 90 and 15 kg Urea, TSP, MOP and gypsum, respectively. Necessary intercultural operations were done as and when necessary. The crop was harvested at proper maturity. Data were collected on plant height, branches plant<sup>-1</sup>, effective pods plant<sup>-1</sup>, non-effective pod plant<sup>-1</sup>, pod length, number of seeds pod<sup>-1</sup>, number of non-effective seeds pod<sup>-1</sup>, number of total seeds pod<sup>-1</sup>, weight of 1000 seeds, seed yield, straw yield and harvest index. The collected data were analyzed using computer package MSTAT and mean differences were adjudged by using Duncan's Multiple Range Test.

## Results and Discussion

### Varietal performance

Branches plant<sup>-1</sup>, pods plant<sup>-1</sup>, effective pods plant<sup>-1</sup>, non-effective pods plant<sup>-1</sup> were higher in BARI Sarisha-9. Higher seed yield (1.54 t ha<sup>-1</sup>) obtained in BARI Sarisha-9 was due to higher branches plant<sup>-1</sup>, pods plant<sup>-1</sup> and effective pods plant<sup>-1</sup>. But higher plant height, pod length, effective seeds plant<sup>-1</sup> and total seeds pod<sup>-1</sup> were found in BARI Sarisha-6 (Table 1).

### Effect of sowing date on the yield and yield attributes of mustard

The effect of sowing date on yield and yield contributing characters was statistically significant. Results revealed that plant height, branches plant<sup>-1</sup>, pods plant<sup>-1</sup>, effective pods plant<sup>-1</sup>, non-effective pods plant<sup>-1</sup>, pod length, seed yield and harvest index (%) decreased with delaying date of sowing and the highest and the lowest values of above parameters were recorded in 10 and 30 November sowing, respectively (Table 1). The highest number of effective seeds pod<sup>-1</sup>, number of non-effective seeds pod<sup>-1</sup> and total seeds pod<sup>-1</sup> were obtained from 20 November sowing and the lowest from 30 November sowing.

### Effect of seed rate on the yield and yield attributes of mustard

Seed rate had on significant influence on straw yield but seed yield and many of the yield parameters were influenced by the treatment (Table 1). Results showed that plant height, branches plant<sup>-1</sup>, pods plant<sup>-1</sup>, effective pods plant<sup>-1</sup>, non-effective pods plant<sup>-1</sup>, pod length, number of effective seeds pod<sup>-1</sup>, total seeds pod<sup>-1</sup>, 1000 seed weight, seed yield, straw yield and harvest index (%) decreased with increasing seed rate and the highest and the lowest value of above parameters were recorded in 8 and 12 kg seed ha<sup>-1</sup> respectively. These results indicated that seed rate at 8 kg ha<sup>-1</sup> was the best for mustard production.

**Table 1. Main effects of sowing date and seed rate on the yield and yield attributes of two mustard varieties**

Variety	Plant height (cm)	No. of branches plant <sup>-1</sup>	No. of pods plant <sup>-1</sup>	No. of effective pods plant <sup>-1</sup>	No. of non-effective pods plant <sup>-1</sup>	Pod length (cm)	No. of effective seeds pod <sup>-1</sup>	No. of non-effective seeds pod <sup>-1</sup>	Wt. of 1000 seeds (g)	Seed yield (t ha <sup>-1</sup> )	Straw yield (t ha <sup>-1</sup> )	HI (%)
V <sub>1</sub>	96.72a	1.59b	138.75b	132.19b	6.56	5.84a	20.63a	1.37	2.68	1.41b	3.34b	29.69b
V <sub>2</sub>	84.86b	3.30a	153.26a	147.35a	5.91	4.74b	13.48b	1.78	2.76	1.54a	3.37a	31.33a
Level of Significance	**	**	**	**	NS	**	**	NS	NS	**	**	**
Sowing date												
D <sub>1</sub>	99.38a	2.94a	161.17a	153.64a	7.52	5.64a	16.67b	1.39b	18.06b	2.77	1.53a	31.36a
D <sub>2</sub>	93.03a	2.50a	147.96b	141.64b	6.32	5.63a	18.39a	1.50ab	20.00a	2.70	1.48b	30.42b
D <sub>3</sub>	79.96b	1.89b	128.89c	124.02c	4.87	4.59b	16.11b	1.83a	17.89b	2.69	1.41c	29.75c
Level of Significance	**	**	**	**	NS	**	**	**	**	NS	**	**
Seed rate												
S <sub>1</sub>	94.54a	3.11a	153.52a	146.58a	6.94	5.42a	18.17a	1.33b	19.50a	2.82a	1.49	30.55
S <sub>2</sub>	90.78ab	2.67b	150.33b	143.66b	6.67	5.29ab	17.56ab	1.72ab	19.33a	2.68b	1.48	30.54
S <sub>3</sub>	87.04c	1.56c	134.16c	129.06c	5.10	5.16b	15.44b	1.67a	17.11b	2.67b	1.45	30.44
Level of Significance	**	**	**	**	NS	**	**	*	**	**	NS	NS
CV (%)	2.41	15.75	3.52	3.45	22.38	4.03	28.01	3.26	4.86	4.86	4.34	

In a column, figures with same letters or without letters under a particular set of treatment do not differ significantly whereas figures with dissimilar letter differ significantly as per DMRT.

NS = Not significant.

V<sub>1</sub> = BARI Sarisha-6, V<sub>2</sub> = BARI Sarisha-9, D<sub>1</sub> = 10 November, D<sub>2</sub> = 20 November, D<sub>3</sub> = 30 November, S<sub>1</sub> = 8 kg ha<sup>-1</sup>, S<sub>2</sub> = 10 kg ha<sup>-1</sup>, S<sub>3</sub> = 12 kg ha<sup>-1</sup>

\* = Significant at 5% level of probability

\*\* = Significant at 1% level of probability.

### Interaction effect of variety and sowing date on the yield and yield attributes of mustard

The effect of variety and sowing date on plant height, branches plant<sup>-1</sup>, pods plant<sup>-1</sup>, effective pods plant<sup>-1</sup>, pod length, number of effective seeds pod<sup>-1</sup>, number of non-effective seeds pod<sup>-1</sup>, total seeds pod<sup>-1</sup>, seed yield, straw yield, and harvest index were statistically significant. The highest seed yield (1.63 t ha<sup>-1</sup>) was obtained from BARI Sarisha-9 sown on 10 November and the lowest seed yield was obtained from BARI Sarisha-9 sown on 30 November (Table 2).

### Interaction effect of variety and seed rate on the yield and yield attributes of mustard

The interaction effect of variety and seed rate on plant height, pods plant<sup>-1</sup>, effective pods plant<sup>-1</sup>, pod length, number of effective seeds pod<sup>-1</sup> and total seeds pod<sup>-1</sup> was statistically significant whereas this interaction had no significant influence on branches plant<sup>-1</sup>, non-effective pods plant<sup>-1</sup>, number of non-effective seeds pod<sup>-1</sup>, seed yield, straw yield, and harvest index. Apparently the highest seed yield (1.55 t ha<sup>-1</sup>) was recorded in BARI Sarisha-9 × 8 kg seed ha<sup>-1</sup> and the lowest seed yield was recorded in BARI Sarisha-6 × 12 kg seed ha<sup>-1</sup> (Table 2).

### Interaction effect of sowing date and seed rate on the yield and yield attributes of mustard

The interaction of sowing date and seed rate had significant influence on plant height, pods plant<sup>-1</sup>, effective pods plant<sup>-1</sup>, pod length, number of effective seeds pod<sup>-1</sup> and total seeds pod<sup>-1</sup>. The highest plant height (104.97 cm) was recorded in the combination of 10 November sowing with 8 kg seed ha<sup>-1</sup>. The highest number of pods plant<sup>-1</sup>, effective pods plant<sup>-1</sup> and pod length were produced by the interaction of 10 November sowing and 10 kg seed ha<sup>-1</sup>. The highest non-effective pods plant<sup>-1</sup> was produced by the interaction of 20 November sowing and 10 kg seed ha<sup>-1</sup> and the highest number of effective seeds pod<sup>-1</sup> and total seeds pod<sup>-1</sup> were recorded in the combination of 20 November sowing with 8 kg seed ha<sup>-1</sup>. Seed yield and other yield contributing characters were not significantly influenced by the interaction of sowing date and seed rate.

**Table 2. Interaction effect of variety and seed rate, variety and sowing date, sowing date and seed rate on the yield and yield attributes of mustard**

Interaction	Plant height (cm)	No. branches plant <sup>-1</sup>	No. of pods plant <sup>-1</sup>	No. of effective pods plant <sup>-1</sup>	No. of non-effective pods plant <sup>-1</sup>	Pod length (cm)	No. of effective seeds pod <sup>-1</sup>	No. of non-effective seeds pod <sup>-1</sup>	No. of total seeds pod <sup>-1</sup>	Wt. of 1000 seed (g)	Seed yield (t ha <sup>-1</sup> )	Straw yield (t ha <sup>-1</sup> )	HI (%)
V <sub>1</sub> ×S <sub>1</sub>	97.47a	2.33	142.93c	135.14c	7.78	6.00a	21.56a	1.11	22.67a	2.76	1.43	3.38	29.71
V <sub>1</sub> ×S <sub>2</sub>	96.81a	1.78	141.22c	134.21c	7.01	5.87ab	20.78a	1.67	22.56a	2.63	1.41	3.30	29.92
V <sub>1</sub> ×S <sub>3</sub>	95.88a	0.67	132.11e	127.21e	4.90	5.66b	19.56a	1.33	20.89a	2.65	1.39	3.34	29.45
V <sub>2</sub> ×S <sub>1</sub>	91.62a	3.89	164.11a	158.02a	6.09	4.85c	14.78b	1.56	16.33b	2.87	1.55	3.38	31.40
V <sub>2</sub> ×S <sub>2</sub>	84.74b	3.56	159.45b	153.12b	6.33	4.71c	14.33b	1.78	16.11b	2.73	1.56	3.44	31.16
V <sub>2</sub> ×S <sub>3</sub>	78.21c	2.44	136.22d	130.91d	5.31	4.65c	11.33c	2.00	13.33c	2.69	1.51	3.29	31.44
Level of Significance	**	NS	**	**	NS	**	**	NS	**	NS	NS	NS	NS
V <sub>1</sub> ×D <sub>1</sub>	107.54a	2.11bc	148.11c	140.03c	8.08	6.02a	19.67b	1.00b	20.67b	2.71	1.44c	3.27c	30.56b
V <sub>1</sub> ×D <sub>2</sub>	96.12b	1.89cd	138.93d	132.62d	6.30	6.11a	21.78a	1.78ab	23.67a	2.69	1.40d	3.47a	28.69d
V <sub>1</sub> ×D <sub>3</sub>	86.49c	0.78d	129.22e	123.91e	5.31	5.39b	20.44ab	1.33ab	21.78b	2.64	1.39d	3.28c	29.83c
V <sub>2</sub> ×D <sub>1</sub>	91.22bc	3.78a	174.22a	167.25a	6.97	5.27bc	13.67cd	1.78ab	15.44cd	2.83	1.63a	3.44ab	32.16a
V <sub>2</sub> ×D <sub>2</sub>	89.93bc	3.11ab	157.00b	150.67b	6.33	5.15c	15.00c	1.22ab	16.33c	2.72	1.55b	3.28c	32.16a
V <sub>2</sub> ×D <sub>3</sub>	73.42d	3.00abc	128.56e	124.13e	4.43	3.79d	11.78d	2.33a	14.00d	2.74	1.43c	3.39b	29.68c
Level of Significance	**	**	**	**	NS	**	**	**	**	NS	*	**	**
D <sub>1</sub> ×S <sub>1</sub>	104.97a	3.50	164.50b	156.50b	8.00	5.77a	18.00ab	1.33	19.33ab	2.88	1.55	3.34	31.77
D <sub>1</sub> ×S <sub>2</sub>	100.35ab	3.33	170.83a	162.96a	7.87	5.81a	17.33ab	1.33	18.67b	2.76	1.54	3.39	31.22
D <sub>1</sub> ×S <sub>3</sub>	92.83c	2.00	148.17c	141.47c	6.70	5.36b	14.67c	1.50	16.17c	2.68	1.51	3.35	31.09
D <sub>2</sub> ×S <sub>1</sub>	97.12bc	3.33	162.55b	155.92b	6.63	5.80a	19.50a	1.17	20.67a	2.81	1.50	3.46	30.28
D <sub>2</sub> ×S <sub>2</sub>	91.60c	2.67	150.67c	143.36c	7.31	5.43b	18.33ab	1.67	20.33ab	2.59	1.48	3.31	30.82
D <sub>2</sub> ×S <sub>3</sub>	90.37c	1.50	130.67e	125.65de	5.02	5.66a	17.33ab	1.67	19.00ab	2.71	1.45	3.36	30.17
D <sub>3</sub> ×S <sub>1</sub>	81.55d	2.50	133.50d	127.32d	6.18	4.70c	17.00b	1.50	18.50b	2.76	1.40	3.34	29.61
D <sub>3</sub> ×S <sub>2</sub>	80.38d	2.00	129.50e	124.67e	4.84	4.63cd	17.00b	2.17	19.00ab	2.70	1.43	3.42	29.59
D <sub>3</sub> ×S <sub>3</sub>	77.93d	1.17	123.67f	120.07f	3.60	4.46d	14.33c	1.83	16.17c	2.61	1.39	3.24	30.07
Level of Significance	**	NS	**	**	NS	**	*	NS	**	NS	NS	NS	NS
CV (%)	2.41	15.75	3.52	3.45	22.38	4.03	28.01	3.26	4.86	4.86	4.34	3.71	3.24

In a column, figures with same letter(s) or without letter(s) in a particular set of interaction do not differ significantly whereas figures with dissimilar letter(s) differ significantly as per DMRT.

The interaction effect of variety, sowing date and seed rate did not significantly influence the yield and yield attributes of mustard.

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