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EFFECTS OF SOWING TIME AND WEED MANAGEMENT ON THE YIELD AND YIELD COMPONENTS OF THREE VARIETIES OF RAPESEED (*BRASSICA CAMPESTRIS* L.)

MST TOWHIDA AKHTER*, MA MANNAN, PB KUNDU AND NK PAUL

Department of Botany, University of Rajshahi, Rajshahi-6205, Bangladesh

Key words: Showing date, Weed management, Rapeseed, Yield components

Abstract

The experiment was conducted to investigate the effects of sowing time and weeding on the seed yield and yield components of three varieties of rapeseed and laid out in a split-split plot design. Four sowing dates in the main plot, two weedings in the sub-plot and three varieties in the sub-sub plot were maintained. The results showed that the different sowing dates, weeding and varieties had significant effect of yield and yield components in two years. All the yield components were observed highest in the 18 October sowing (S_1). Two hand weeding (W_2) treatment and BINA Sarisha-5 produced the highest seed yield and yield components in both the years.

Introduction

Oil seed crops are very important for human food and have gained third position among the crops next to cereals and legumes (Downey 1990). Rapeseed (*Brassica campestris* L.) is a winter season crop. It is also a thermosensitive as well as photosensitive crop (Ghosh and Chatterjee 1988). As sowing time is one of the most important factors affecting crop yield and other agronomic traits, the optimisation of sowing time for winter rapeseed is essential. Sowing either too early or too late has been reported to be unfavourable (Uzun *et al.* 2009). In late autumn sowing seed germination is very slow and this leads to limited seedling development (Christensen and Drabble 1984). There are several reports on the effect of sowing date on agronomical traits, but the results varied (Hocking *et al.* 1997, Ozer 2003). Late sowings not only reduce the seed yield, but also decrease oil level in winter rapeseed (Ozer 2003). Although rapeseed plants have large leaf, rapid growth and early canopy closing, still weed competition is very critical during the early stand establishment (Joel *et al.* 1995). Besides lowering production, weeds also decrease oil quality (Bagherani and Shimi 2001). Several methods have been used for weed control in rapeseed, like hand weeding, cultivation in row cropping and use of chemicals. Hand weeding is still the conventional weed control practice in rapeseed. While the studies of Yadav 2004 and Chauhan *et al.* 2005 revealed that hand weeding twice increased seed and oil yields, pods/plant and 1000-seed weight.

The present study was undertaken to find out the effect of sowing time and weeding on the yield and yield components of three varieties of rapeseed, and also to explore suitable varieties for optimum sowing time and weeding specially for the northern part of Bangladesh.

Materials and Methods

The experiment was carried out at the experimental field of Rajshahi University Campus (Agro-Ecological Zone 11), Bangladesh (24°75′ N latitude and 90°50′ E longitude) during from October, 2006 to March, 2007 and October, 2008 to March, 2009 growing seasons. The soil type was silty loam, having pH 7.5 as well as 35% of field capacity.

*Author for correspondence: <towhida_akhter@yahoo.com>.

The experiment was laid out in a split-split plot design with three replications. Each replicated field was divided into four main plots for sowing treatments (S_1 = 18 October, S_2 = 2 November, S_3 = 17 November, S_4 = 3 December). Each main plot was divided into three sub-plots for weeding treatment (W_0 = no weeding, W_1 = one hand weeding, W_2 = two hand weeding). Each sub-plot was lastly divided into three sub-sub plots for three varieties of rapeseed (V_1- BARI Sarisha-14, V_2- BINA Sarisha-5 and BINA Sarisha-6). Each plot size was 4 m × 3 m, i.e., 12 m^2 having a plot to plot distance 1 m to the north-south, 2 m to the east-west; replication to replication distance 2 m, row to row 30 cm, and plant to plant 10 cm approximately. Border rows were not considered because of the border effect.

At harvest, the three middle rows were used for sampling and measuring parameters. For sampling, ten plants from the middle of each plot were harvested. The following traits plant height, branches/plant, siliquae/plant, siliquae/plant, seeds/siliqua, 1000-seed weight, seed yield were studied. Data were analyzed with a computer using the IRRISTAT software. A factorial analysis of variance (ANOVA) was performed for all parameters.

Results and Discussion

Sowing date, weeding and genotype influenced the yield and yield attributes of rapeseed. Analysis of variance is shown in Table 1 and mean results are given in Tables 2, 3 and 4.

Sowing date linearly shortened the plant height significantly (Table 1). The highest plant height was obtained from 18 October sowing in both the years (Table 2). The results are in conformity with those of Bhuiyan *et al.* 2008, Razzaque *et al.* 2007, Uzun *et al.* 2009 and Fashami *et al.* 2012. In case of plant height, the effect of weeding was also significant (Table 1). Among the treatments two weeding plots had the highest plant height while no weeding had the minimum plant height (Table 3). Similar result was noticed in canola by Roshdy *et al.* 2008 and Mekki *et al.* 2010. Further, plant height significantly varied among the varieties. BINA Sarisha-6 possessed the maximum plant height while BARI Sarisha-14 had the minimum plant height (Table 4).

Analysis of the data revealed that different sowing times, weeding and varieties had significant effect on the number of branches/plant (Table 1). Maximum branches/plant was obtained from sowing done on 18 October but 3 December sowing gave minimum branches/plant (Table 2). These results are in conformity with the findings of Angrej *et al.* 2002 in mustard, Sharif and Keshta 2002 in canola, Bhuiyan *et al.* 2008 and Fashami *et al.* 2012 in rapeseed. Comparison of the treatment means reflected that maximum branches/plant was recorded where two weedings were conducted, while minimum number was counted in the no weeding (Table 3). The possible reason for increase in number of branches/plant by weeding could be the best of control and consequently increased nutrients availability to the crop while the reason for minimum number of branches/plant in no weeding could be attributed to weed competition for nutrients, light, moisture and space. These results are in agreement with Larik *et al.* (1999) and Rashid *et al.* (2007) in rapeseed. Varieties were characteristically different in producing branches/plant. BINA Sarisha-5 produced highest branches/plant followed by BARI Sarisha-14 and BINA Sarisha-6 (Table 4).

Sowing date had a great influence on the number of siliquae/plant, which may have apparent impact on seed yield. Table 2 shows that sowing dates of 18 October and 3 December had the highest and the lowest number of siliquae/plant, respectively in both the years. It seems that in early planting date due to longer vegetative period, more branches were produced. Rahman *et al.* 1993 reported that the number of siliquae/plant greatly reduced for each week delay after 2 November sowing. On the other hand, the highest number of siliquae/plant was recorded in two weedings plots while the lowest number was noted in no weeding (Table 3). Similar results have

been reported by Yadav *et al.* 1995 in mustard, Marwat *et al.* 2003 in rapeseed, Mekki *et al.* 2010 in canola. Bina Sarisha-5 had the highest number of siliquae/plant followed by BARI Sarisha-14 and BINA Sarisha-6 (Table 4).

Table 1. Mean squares from the analysis of variance of yield and yield components of three rapeseed varieties as influenced by sowing dates and weeding treatments.

Source of variation	df	Height/ plant (cm)	Branch no./plant	Siliquae no./plant	Seed no./ siliquae	1000-seed wt.(g)	Seed yield (kg/ha)
				2006-2007			
Replication (R)	2	24.36**	0.34 ns	403.89**	11.15**	0.01 ns	12117 ns
Sowing (S)	3	799.42**	26.99**	16477.56**	21.38**	1.01**	2700931**
Error (a)	6	0.10	0.09	7.05	0.12	0.01	3637
Weeding (W)	2	228.53**	38.17**	6808.73**	33.06**	1.04**	1323777**
S × W	6	2.31**	0.44**	1046.95**	0.52**	0.03**	89929 **
Error (b)	16	0.19	0.09	2.18	0.06 ns	0.003 ns	5037 ns
Variety (V)	2	3319.19**	28.66**	6185.62**	737.37**	0.79**	510249**
S × V	6	27.97**	0.11 ns	466.95**	0.16 ns	0.02**	26137**
W × V	4	7.51**	0.93**	622.70**	2.18**	0.01 ns	8418**
S × W × V	12	4.46**	0.23**	94.93**	0.35*	0.001 ns	1150 ns
Error (c)	48	11.56	3.22	2.84	0.17	0.003	1020
				2008-2009			
Replication (R)	2	32.12**	0.18 ns	1237.01**	11.15**	0.01 ns	11721. ns
Sowing (S)	3	653.03**	13.66**	13406.70**	21.38**	1.01**	2296859**
Error (a)	6	0.05	0.09	43.18	0.12	0.01	3593 ns
Weeding (W)	2	202.39**	26.84**	4266.45**	33.06**	1.04**	1323867**
S × W	6	6.27**	0.76**	726.89**	0.52**	0.03**	90107**
Error (b)	16	0.12	0.04	26.46	0.06	0.003	4851
Variety (V)	2	3151.21**	25.73**	4915.34**	737.37	0.79**	509061**
S × V	6	12.36**	0.16*	382.11**	0.16 ns	0.02**	25541**
W × V	4	9.29**	0.76**	446.94**	2.18**	0.01 ns	8400**
S × W × V	12	6.76**	0.23**	76.50**	0.35*	0.001 ns	1244 ns
Error (c)	48	0.21	0.06	5.48	.017	0.004	1086

ns = Non-significant; , * = 5%, ** = 1% level of significance, respectively.

Number of seeds/siliqua was significantly affected by various sowing dates, weeding treatments and different varieties. The highest number of seeds/siliqua was obtained from 18 October sowing which was significantly at par than other sowing dates in both the years (Table 2). Last sowing (3 December) produced the lowest number of seeds/siliqua. The results of the present investigation with respect of seeds/siliqua fairly agreed with the findings of Nag *et al.* (2000), Razzaque *et al.* (2007), Bhuiyan *et al.* (2008) and Fashami *et al.* (2012) who observed decreased seeds/siliqua in rapeseed due later sowing. The data in Table 3 exhibited the highest number of seeds/siliqua obtained from two weeding treatment, while the lowest number of seeds/siliqua was found in no weeding. Similar result has been reported by Raghavan and Hariharan (1991), Marwoat *et al*. (2003), Mekki *et al.* (2010). Varieties were characteristically different in

producing seeds/siliqua. BINA Sarisha-5 produced highest seed/siliqua followed by BARI Sarisha-14 and BINA Sarisha-6 (Table 4).

Table 2. Mean values of yield and yield components of three rapeseed varieties as influenced by sowing date in two seasons.

Showing	Height/ plant (cm)	Branch no./plant	Siliquae no./plant	Seed no./ siliquae	1000-seed wt. (g)	Seed yield (kg/ha)	% of decrease in seed yield
			2006-2007				
S_1 (18 October)	106.81	5.78	77.89	22.56	3.21	1052.00	-
S_2 (02 November)	100.04	4.70	58.63	21.59	3.05	886.67	15.72
S_3 (17 November)	97.22	4.27	43.07	21.00	2.88	526.67	50.00
S_4 (03 December)	94.04	3.37	37.30	20.48	2.77	366.00	65.21
LSD (5%)	0.21	0.20	1.77	0.23	0.07	40.21	
			2006-2007				
S_1 (18 October)	102.78	4.67	78.93	22.56	3.11	908.00	-
S_2 (02 November)	96.59	4.04	58.63	21.59	2.95	814.67	10.28
S_3 (17 November)	93.79	3.37	35.67	21.00	2.78	454.67	49.93
S_4 (03 December)	91.37	3.07	30.59	20.48	2.67	294.00	67.62
LSD (5%)	0.15	0.20	4.38	0.23	0.06	39.26	

Table 3. Mean values of yield and yield components of three rapeseed varieties as influenced by weeding in two seasons.

Weeding	Height/ plant (cm)	Branch no./plant	Siliquae no./plant	Seed no./ siliquae	1000-seed wt.(g)	Seed yield (kg/ha)	% of decrease in seed yield
			2006-2007				
W_0 (No weeding)	96.92	3.39	44.44	20.44	2.80	515.00	42.68
W_1 (One weeding)	99.72	4.81	52.61	21.42	2.99	710.00	20.98
W_2 (Two weeding)	101.94	5.39	65.61	22.36	3.14	898.50	-
LSD (5%)	0.25	0.17	0.85	0.14	0.03	40.98	
			2008-2009				
W_0 (No weeding)	93.91	2.89	40.64	20.44	2.70	425.00	47.43
W_1 (One weeding)	95.86	3.86	49.89	21.42	2.89	620.00	23.31
W_2 (Two weeding)	98.63	4.61	62.33	22.36	3.04	808.50	-
LSD (5%)	0.20	0.12	2.97	0.14	0.03	40.22	

Sowing date had a great influence on 1000-seed weight. The highest 1000-seed weight was obtained from 1st sowing (18 October) in both the years (Table 2) which corroborates with the findings of Islam *et al.* (2000), Razzaque *et al.* (2007), Bhuiyan *et al.* (2008) and Fashami *et al.* (2012) in rapeseed. Among the weeding treatments the maximum 1000-seed weight was obtained from two weeding plots while the lowest 1000-seed weight was obtained from no weeding in both the years (Table 3). The results are in conformity with Yadav (2004), Chauhan *et al.* (2005), Rashid *et al.* (2007), Mekki (2007) and Mekki *et al.* (2010). Varietal characteristics were more

pronounced in 1000-seed weight. The highest 1000-seed weight was produced by BINA Sarisha-5 and the lowest was in BINA Sharisha-6 in both the growing seasons (Table 4).

Table 4. Mean values of yield and yield components of three rapeseed varieties as influenced by variety in two seasons.

Variety	Height/plant (cm)	Branch no./plant	Siliquae no./plant	Seed no./ siliquae	1000-seed wt. (g)	Seed yield (kg/ha)
			2006-2007			
V_1 (BARI Sarisha-14)	92.17	4.22	50.78	19.22	2.95	6.74.50
V_2 (BINA Sarisha-5)	96.03	5.54	65.67	26.61	3.14	840.00
V_3 (BINA Sarisha-6)	110.39	3.83	46.22	18.39	2.84	609.00
LSD (5%)	1.96	1.04	0.97	0.24	0.03	18.44
			2008-2009			
V_1 (BARI Sarisha-14)	89.24	3.44	47.19	19.22	2.85	584.50
V_2 (BINA Sarisha-5)	92.37	4.75	64.06	26.61	3.04	750.00
V_3 (BINA Sarisha-6)	106.78	3.17	41.61	18.39	2.74	519.00
LSD (5%)	0.26	0.14	1.35	NS	0.04	19.03

Sowing date mean comparison on yield showed that sowing date in 18 October and 3 December had maximum and minimum seed yield, respectively in both the years (Table 2). A decreased yield in delayed planting was reported by some researchers (Nag *et al.* 2000, Islam *et al.* 2000, Razzaque *et al.* 2007, Bhuiyan *et al*. 2008 and Fashami *et al*. 2012). Weeding data indicated that maximum seed yield was produced by two weeding plots. While minimum seed yield was obtained in no weeding (Table 3). Which agrees with the results reported by Singh *et al.* 2000, Marwat *et al.* 2003, Hamzei *et al.* 2007, Miri and Rahimi 2009 and Mekki *et al.* 2010. Among the varieties BINA Sarisha-5 gave highest seed yield and BINA Sarisha-6 produced lowest yield in both the growing seasons (Table 4).

Delayed sowing decreased seed yield by 15.72, 50.00 and 65.21% in the first year and 10.28, 49.93 and 67.62% in the second year, respectively 2 November, 17 November and 3 December sowing compared to 18 October sowing. These findings agreed with Rahman *et al.* 1993, Brar *et al.* 1998, Mondal *et al.* 1999, Nag *et al.* 2000, Razzaque *et al.* 2007 and Fashami *et al.* 2012.

The decrease in seed yield by 42.68 and 20.98% in the 1st year and 47.43 and 23.31 in the second year was found for no weeding and one weeding, respectively from two weeding. Similar results were reported by Singh *et al.* (2000), Hamzei *et al.* (2007), Miri and Rahimi (2009) and Mekki *et al.* (2010).

Selection of most appropriate sowing date is one of the key points in crop management to optimizing productivity (Bhuiyan *et al.* 2008). This study provides information about the effect of different sowing dates on yield and yield components of rapeseed (*B. campestris* L.) under different weeding regimes. Seed yield decreased with delayed sowing time. Weed interference in oil crops and specifically rapeseed causes significant yield reductions. Duration of weeding in the field also affect yield as do damage to the cop plants;, which vary from one weed to another. Weed control should be affected early in the growth period, especially the first four weeks;, which is the critical period of competition in rapeseed. In this experiment, among the three varieties, BINA Sarisha-5 was found to be most suitable for the first sowing date (18 October) in terms of seed yield. It can be suggested that the most appropriate sowing time for desired seed yield and quality in rapeseed was mid October for the experimental region.

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