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GROWTH ATTRIBUTES OF RAPESEED VARIETIES (BRASSICA CAMPESTRIS L.) IN RELATION TO SOWING DATES AND WEEDINGS TREATMENTS

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Abstract

Context: To analyze the effect of sowing dates and weeding treatments on growth attributes such as total dry matter (TDM), leaf area index (LAI), net assimilation rate (NAR), crop growth rate (CGR), leaf area ratio (LAR) of three rapeseed (Brassica campestris L.).

Objectives: The objective of the study was to identify the growth in relation to sowing dates and weed competition and identify the weeding number for better growth of rapeseed.

Materials and Methods: This investigation was arranged as factorial experiment based on the split-split plot design with three replications. Four sowing dates were including 18 October (S_1), 12 November (S_2), 17 November (S_3) and 3 December (S_4) and three weeding treatments were no weeding (W_O), one hand weeding (W_1) and two hand weeding (W_2) and three varieties viz., BINA Sarisha-5, BINA Sarisha-6 and BARI Sarisha-14 were investigated.

Results: The results showed that, TDM, LAI, CGR, NAR and LAR were affected by sowing date and weeding treatments. The highest TDM, LAI and CGR were obtained in the first sowing and two weedings treatment. The highest NAR was found in S_2 plants and W_0 treatment. The highest LAR was found in S_2 plants and W_1 treatment.

Conclusion: The results obtained in this study suggest that the first sowing and two weeding treatments are superior for the production of rapeseed.

Key words: Rapeseed, Sowing date, weeding, growth attributes.

Introduction

Rapeseed (Brassica campestris L.) ranks first among the oilseed crops of Bangladesh. Rapeseed occupies almost 71% land whereas the other oilseeds in the rest of the land. It covers about 61.2% of the total acreage under oilseed and 58% of the total oil seed production (BBS. 2010). Rapeseed has a better teste as well as highest level of unsaturated fatty acid. And thus helps lowering blood cholesterol levels (Marwat et al. 2003). It is also a rich source of oil and protein and contains more than 40% oil (Weiss1983).

As wheat and rice are the staple food crop of Bangladesh, so lesser attention is given to oilseed crops of rabi season. That is why rapeseed is only grown on almost rainfed and less fertile areas. As a result not enough edible oil is produced to fulfil the domestic requirement. So edible oil is imported by spending a lot of foreign exchange. Many physiological processes associated with crop growth and developments are influenced by sowing date. Appropriate time of sowing enables the crop plant to enjoy suitable climatic conditions for their growth and development which largely influence yield (Paul and Sarker 2003).

Rapeseed is a smoother crop because of its larger leaves, rapid growth and early canopy closing. Still weed competition is very critical during the early stand establishment particularly the parasitic weed (Joel et al. 1995). Due to smaller seed size of the crop it is difficult to separate weed seeds from it. Several methods

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have been used for weed control in canola, like hand weeding, cultivation in row cropping and use of chemicals. But most reliance is made on hand weeding. Khan et al. (1995) suggested the use of post-emergence with hand weeding for controlling weeds in rapeseed if proper pre-emergence herbicide is not available. The present study was undertaken to investigate the impact of optimum sowing date and suitable weeding treatment on growth dynamics of three rapeseed varieties.

Materials and Methods

Experimental field

The experiment was carried out at the experimental field of Rajshahi University Campus (Agro-Ecological Zone 11), Bangladesh (2475 N latitude and 9050 E longitude) during the period 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.

Treatment

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 weedings). Each sub-plot was lastly divided into four sub-sub plots for three varieties (namely BINA Sarisha-5, BINA Sarisha-6 and BARI Sarisha-14) of rapeseed. Each plot size was 4 m 3 m, i.e., 12 m^2 having a plot to plot distance 1m to the North-South, 2 m to the East-West; replication to replication distance was 2 m, row to row 30 cm, and plant to plant 10 cm approximately. Border rows were not considered because of the border effect.

Data analysis

At harvest, the three middle rows were used for sampling. For growth analysis, ten plants from the middle of each plot were harvested at 7 days intervals and the first harvest was taken at 20 days after sowing (DAS).The following traits were studied; TDM, LAI, CGR, NAR and LAR. Analysis of variance was performed with a personal computer using the IRRISTAT software. A factorial analysis of variance (ANOVA) was performed for all the parameters. Statistical analysis was carried out according to Gomez and Gomez (1984).

Results and Discussion

Analysis of variance indicated that the differences among the sowing dates and weeding treatments were found to be significant for all the growth attributes at most of the growth stages.

Effect of sowing date

In the present experiment, the highest TDM was found to be in plants grown under S_1 condition and lowest under S_4 condition at all the stages of growth (Table 1). Similar results were reported in rapeseed by Dehdeshti et al. (2006) and Hokmalipour et al. (2011). TDM increased slowly at the early stages of growth and then increased rapidly with the advancement of plant age. Similar result was reported in rapeseed by Kundu and Paul (1998), Dehdeshti et al. (2006) and Hokmalipour et al. (2011). S_1 plants had higher LAI than the plants of other sowings (Table 2). Similar result was reported by Clarke and Simpson (1987) and Paul and Kundn (1991) in rape and Hussain et al. (1997) and Ghosh et al. (2003) in mustard. Starting from lower value, LAI reached a certain value and then declined with plant age. Similar result was reported by Prodhan and Ghosh (1986) and Samanta et al. (1997).

Table 1. Mean values of total dry matter (gm^{-2}) at different growth stages as influenced by sowing date (mean of three replications) in two seasons.

Sowing	Days after sowing							
	21	28	35	42	49	56	63	70
2006-2007								
S_1(18 October)	5.791	18.647	62.420	153.484	205.261	258.718	328.468	352.207
S_2(02 November)	5.620	16.464	39.000	83.145	104.584	156.243	232.179	254.845
S_3(17 November)	3.425	11.635	25.335	47.916	85.680	109.328	156.567	162.215
S_4(03 December)	2.449	9.557	18.348	32.733	65.499	86.231	112.999	117.100
LSD(5%)	0.33	2.72	4.63	3.64	7.70	7.35	11.70	10.57
2008-2009								
S_1(18 October)	4.249	14.127	41.795	116.191	190.088	241.056	311.223	362.695
S_2(02 November)	4.223	11.429	33.040	75.113	103.911	144.064	211.067	230.193
S_3(17 November)	3.113	9.928	23.347	39.444	81.393	103.756	145.680	151.072
S_4(03 December)	2.251	7.837	17.408	30.763	62.425	83.803	105.212	106.617
LSD(5%)	0.19	0.62	3.38	3.63	2.62	6.40	5.33	8.05

Table 2. Mean values of leaf area index at different growth stages as influenced by sowing date (mean of three replications) in two seasons.

Sowing	Days after sowing							
	21	28	35	42	49	56	63	70
	2006-2007							
S_1(18 October)	0.119	0.392	0.974	1.410	0.879	0.557	0.294	0.159
S_2(02 November)	0.135	0.365	0.632	0.837	0.413	0.314	0.234	0.146
S_3(17 November)	0.070	0.231	0.432	0.531	0.396	0.304	0.222	0.098
S_4(03 December)	0.052	0.181	0.316	0.378	0.386	0.304	0.209	0.080
LSD(5%)	0.025	0.058	0.102	0.198	0.059	0.076	0.038	0.021
	2008-2009							
S_1(18 October)	0.085	0.287	0.745	1.145	0.838	0.541	0.289	0.119
S_2(02 November)	0.092	0.262	0.541	0.785	0.392	0.383	0.221	0.099
S_3(17 November)	0.064	0.218	0.353	0.381	0.358	0.317	0.184	0.071
S_4(03 December)	0.054	0.170	0.248	0.408	0.330	0.283	0.161	0.060
LSD(5%)	0.013	0.015	0.053	0.055	0.039	0.029	0.016	0.009

Based on the findings, at different sowing dates, CGR was higher in the early sown plants. The highest CGR was in S_1 plants (Table 3). Similar result was obtained by Biswas et al. (2002) in blackgram and Hokmalipour et al. (2011) in canola. CGR increased up to a certain peak and thereafter declined and then increased gradually and sharply reached their highest value and again declined at the later stages of growth. Similar trend was also observed by Clarke and Simpson (1978) in rape and Mondal and Paul (1992) in mustard. In the present investigation, the highest NAR was found in the second sowing when the maximum temperature was 30C. Wilson (1966) reported that NAR of rape, sunflower and maize growse with temperature up to maximum at 28C. With a few exceptions, NAR increased very slowly at the early stages, then reached its

peak and declined thereafter (Table 4). A similar occurrence was evident in mustard by Mondal and Paul (1992, 1994), in rapeseed by Sarker and Paul (1993). S_2 plants had the highest LAR at 1st harvest interval in the 1st year and S_4 plants in the 2nd year (Table 5). S_1 plant had the lowest LAR at last harvest interval. Similar result was reported by Mondal and Paul (1992, 1994) in mustard. Lower LAR might be due to abscission of older leaves at the later growing stages. Similar result was also reported by Islam and Paul (1986) in rape, Mondal and Paul (1992) in mustard.

Table 3. Mean values of crop growth rate (g $m^{-2}day^{-1}$) at different growth stages as influenced by sowing date (mean of three replications) in two seasons.

Sowing	Days after sowing						
	21-28	28-35	35-42	42-49	49-56	56-63	63-70
2006-2007							
S_1(18 October)	1.837	6.253	13.009	7.397	7.637	9.964	3.391
S_2(02 November)	1.549	3.219	6.306	3.063	7.380	10.848	3.238
S_3(17 November)	1.173	1.957	3.226	5.395	3.378	6.748	0.807
S_4(03 December)	1.015	1.256	2.055	4.681	2.962	3.824	0.586
LSD(5%)	0.411	0.909	0.516	1.155	1.276	0.952	1.193
2008-2009							
S_1(18 October)	1.411	3.953	10.628	10.557	7.281	10.024	7.353
S_2(02 November)	1.030	3.087	6.010	4.114	5.736	9.572	2.732
S_3(17 November)	0.974	1.917	2.300	5.993	3.195	5.989	0.770
S_4(03 December)	0.798	1.367	1.908	4.523	3.054	3.058	0.146
LSD(5%)	0.099	0.549	0.925	0.715	1.013	0.743	0.819

Table 4. Mean values of net assimilation rate (g $cm^{-2}day^{-1}$) at different growth stages as influenced by sowing date (mean of three replications) in two seasons.

Sowing	Days after sowing						
	21-28	28-35	3542	42-49	49-56	56-63	63-70
2006-2007							
S_1(18 October)	0.0008	0.0009	0.0011	0.0007	0.0013	0.0026	0.0019
S_2(02 November)	0.0007	0.0007	0.0008	0.0005	0.0019	0.0042	0.0024
S_3(17 November)	0.0009	0.0006	0.0006	0.0012	0.0010	0.0027	0.0005
S_4(03 December)	0.0010	0.0005	0.0006	0.0012	0.0008	0.0017	0.0004
LSD(5%)	NS	NS	0.00009	0.00009	0.0003	0.0003	0.001
2008-2009							
S_1(18 October)	0.0008	0.0009	0.0012	0.0011	0.0012	0.0027	0.0043
S_2(02 November)	0.0006	0.0008	0.0009	0.0008	0.0014	0.0035	0.0021
S_3(17 November)	0.0008	0.0007	0.0006	0.0017	0.0009	0.0025	0.0006
S_4(03 December)	0.0008	0.0006	0.0006	0.0012	0.0010	0.0015	0.0001
LSD(5%)	0.00009	0.00003	0.0003	0.0002	0.0003	0.0004	0.001

Table 5. Mean values of leaf area ratio (cm^2g^{-1}) at different growth stages as influenced by sowing date (mean of three replications) in two seasons.

Sowing	Days after sowing						
	21-28	28-35	35-42	42-49	49-56	56-63	63-70
2006-2007							
S_1(18 October)	208.523	175.543	117.226	63.814	30.608	14.141	6.231
S_2(02 November)	228.424	187.509	126.241	64.857	29.319	14.674	7.266
S_3(17 November)	197.746	182.292	140.227	73.353	36.053	19.461	8.954
S_4(03 December)	197.125	177.736	141.010	83.685	46.106	25.034	11.129
LSD(5%)	NS	NS	NS	9.38	4.29	1.20	0.74
2008-2009							
S_1(18 October)	201.974	171.649	123.997	65.918	32.015	14.732	5.558
S_2(02 November)	222.018	189.214	127.307	63.871	32.346	16.897	6.696
S_3(17 November)	211.032	180.210	122.896	64.774	36.756	19.645	7.697
S_4(03 December)	224.312	171.809	139.051	83.937	42.669	22.971	9.434
LSD(5%)	NS	NS	8.43	5.32	2.63	0.95	0.72

Effect of weeding

TDM was higher in all the weeding plants than in the control plants (Table 6). Increased weeding level increased TDM. W_2 treatment had the highest TDM. Similar trends of the effect of weeding were also observed in rapeseed by Rajput et al. (1993) and Rashid et al. (2007).

Table 6. Mean values of total dry matter (gm^{-2}) at different growth stages as influenced by weeding (mean of three replications) in two seasons.

Weeding	Days after sowing							
	21	28	35	42	49	56	63	70
2006-2007								
W_0(No weeding)	4.274	10.533	23.972	52.161	82.376	111.988	157.910	174.119
W_1(One weeding)	4.246	15.260	38.994	81.377	113.008	146.822	205.756	217.690
W_2(Two weeding)	4.444	16.434	45.861	104.421	150.385	199.080	258.993	272.966
LSD(5%)	NS	0.36	1.15	1.78	2.23	2.33	1.88	2.96
2008-2009								
W_0(No weeding)	3.425	9.184	21.347	46.764	79.576	107.146	151.038	172.197
W_1(One weeding)	3.450	11.541	32.043	66.416	107.047	139.528	192.405	212.134
W_2(Two weeding)	3.502	11.767	33.302	82.953	141.740	182.835	236.443	253.602
LSD(5%)	NS	0.24	1.13	1.95	2.81	1.36	1.95	2.19

Higher LAI was in the weeding levels than in the control. The highest LAI was in W_2 treatment. Miri and Rahimi (2009) reported that in rapeseed lack of weed competition and increased weed free duration can result in increasing crop LAI. Miri and Ghadiri (2006) also showed that in safflower plants weed free plots reached its maximum LAI earlier and maintained a maximum LAI for a longer period compared to weedy check (Table 7). Higher CGR was in the weeding plants than in the control (Table 8) and the highest CGR was in the W_2

treatment. This result is in agreement with crops like rapeseed by Mousavi and Shimi (2004), in canola by Pourazar and Shimi (2004) and Marwat et al. (2005).

Table 7. Mean values of leaf area index at different growth stages as influenced by weeding (mean of three replications) in two seasons.

Weeding	Days after sowing							
	21	28	35	42	49	56	63	70
	2006-2007							
W_0(No weeding)	0.089	0.217	0.405	0.577	0.372	0.277	0.162	0.053
W_1(One weeding)	0.093	0.325	0.631	0.809	0.523	0.377	0.241	0.121
W_2(Two weeding)	0.100	0.336	0.728	0.982	0.661	0.456	0.316	0.188
LSD (5%)	NS	0.031	0.060	0.076	0.053	0.032	0.017	0.013
	2008-2009							
W_0(No weeding)	0.070	0.202	0.351	0.498	0.363	0.321	0.160	0.055
W_1(One weeding)	0.075	0.254	0.518	0.694	0.465	0.357	0.215	0.100
W_2(Two weeding)	0.076	0.246	0.546	0.848	0.611	0.464	0.265	0.106
LSD (5%)	NS	0.015	0.019	0.047	0.034	0.016	0.017	0.007

Table 8. Mean values of crop growth rate (g $m^{-2}day^{-1}$) at different growth stages as influenced by weeding (mean of three replications) in two seasons.

Weeding	Days after sowing						
	21-28	28-35	35-42	42-49	49-56	56-63	63-70
	2006-2007						
W_0(No weeding)	0.894	1.920	4.027	4.316	4.230	6.560	2.316
W_1(One weeding)	1.573	3.391	6.055	4.519	4.831	8.419	1.705
W_2(Two weeding)	1.713	4.204	8.366	6.566	6.956	8.559	1.996
LSD (5%)	NS	0.349	0.788	0.415	0.418	0.538	NS
2008-2009							
W_0(No weeding)	0.823	1.738	3.631	4.687	3.939	6.270	3.023
W_1(One weeding)	1.156	2.929	4.910	5.804	4.640	7.554	2.818
W_2(Two weeding)	1.181	3.076	7.093	8.398	5.871	7.658	2.410
LSD (5%)	0.039	0.164	0.376	0.404	0.348	0.250	0.389

The highest NAR was observed in W_0 plants at 56-63 DAS (Table 9). NAR increased very slowly at the early stages, then reached its peak and declined thereafter. Similar result was reported by Yadav et al. (1995), Khan et al. (1995) and Singh et al. (2000) in rapeseed and mustard. The highest LAR was in the W_1 plant at the first harvest interval and the lowest was in W_0 plant at the last harvest interval (Table 10).

Table 9. Mean values of net assimilation rate (g $cm^{-2}day^{-1}$) at different growth stages as influenced by weeding (mean of three replications) in two seasons.

Weeding	Days after sowing						
	21-28	28-35	3542	42-49	49-56	56-63	63-70
2006-2007							
W_0(No weeding)	0.0007	0.0006	0.0007	0.0010	0.0012	0.0032	0.0023
W_1(One weeding)	0.0009	0.0007	0.0007	0.0008	0.0011	0.0028	0.0009
W_2(Two weeding)	0.0009	0.0008	0.0009	0.0009	0.0014	0.0023	0.0008
LSD (5%)	0.00008	0.00007	0.00009	0.00008	0.00009	0.0002	0.001
2008-2009							
W_0(No weeding)	0.0007	0.0006	0.0008	0.0012	0.0011	0.0027	0.0026
W_1(One weeding)	0.0008	0.0008	0.0007	0.0011	0.0012	0.0027	0.0016
W_2(Two weeding)	0.0008	0.0008	0.0010	0.0012	0.0011	0.0023	0.0012
LSD (5%)	0.00006	0.00005	0.0002	NS	Ns	0.0003	0.0003

Table 10. Mean values of leaf area ratio (cm^2g^{-1}) at different growth stages as influenced by weeding (mean of three replications) in two seasons.

Weeding	Days after sowing						
	21-28	28-35	35-42	42-49	49-56	56-63	63-70
2006-2007							
W_0(No weeding)	204.518	182.900	137.223	74.563	35.882	16.985	6.135
W_1(One weeding)	212.452	182.894	130.855	72.332	36.832	19.198	8.845
W_2(Two weeding)	206.894	176.516	125.450	67.386	33.850	18.799	10.205
LSD (5%)	NS	NS	6.60	4.18	1.79	0.87	0.64
2008-2009							
W_0(No weeding)	212.377	185.309	129.087	70.758	38.900	19.010	6.417
W_1(One weeding)	220.772	177.231	128.975	69.773	34.475	18.391	8.195
W_2(Two weeding)	211.353	172.121	126.877	68.344	34.465	18.282	7.427
LSD (5%)	NS	8.14	NS	NS	1.61	NS	0.49

Conclusion

TDM, LAI, CGR decreased with late sowing. The first sowing plants had higher values of the above characters. There was no clear pattern of LAR. The highest and lowest TDM, LAI and CGR were found in the W_2 and W_0 treatments, respectively. W_1 treatment had the highest NAR and LAR and the lowest were found in W_0 treatment.

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