Variation in growth rate and seed yield of *Brassica juncea* genotypes as affected by nitrogen levels

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Abstract

Crop growth rate (CGR) increased rapidly upto 60-90 DAS and suddenly declined thereafter, whereas, relative growth rate (RGR) was maximum at initial growth stage and declined later on throughout the growth period. CGR was better in RH-9707 and RGR in RH-9510. At initial stages, with the application of nitrogen, CGR increased significantly, whereas in RGR reverse trend was observed. Maximum mustard yield (1804.3 kg ha^{-1}) was obtained from RH-9707 followed by RH-9304 (1771.4 kg ha^{-1}) genotype. Yield increased significantly only up to 80 kg N ha^{-1}.

Key words: Indian mustard, *Brassica juncea*, genotypes**,** nitrogen levels, dry matter accumulation, CGR, RGR, yield

Introduction

Oilseeds, the raw material for vegetable oils occupy a significant place in India's national economy next only to food grains, accounting for about 10% of the cultivated area and value of all agricultural produce (Upadhay *et al*., 2000). Raya (Brassica juncea Czen & Coss) has an important position among oilseed crops grown in India. The lower productivity in India than in other developed countries may be due to low yielding strains and faulty management practices including fertilizers. Hence the present study was taken up to outline the growth rate of mustard genotypes in relation to N-fertilization.

Materials and Methods

A field experiment was conducted at Research Farm of CCS, Haryana Agricultural University, Hisar, India during winter (rabi) seasons of 2002-03 and 2003-04, to study the performance of promising *Brassica juncea* genotypes under different fertility situations. The tratmnets comprised eight genotypes in main plots and four n levels in sub plots(Tables 1 and 2) and the experiment was laid out in split plot design replicated thrice.The soil of the experimental field was sandy loam in texture and medium in fertility with slightly alkaline in reaction (pH 8.0). Crop was sown on 23 October 2002 and 10 October 2003 with hand plough at row to row distance of 30 cm. Thinning was done at 20 DAS to maintain the plant to plant distance at about 10-15 cm. For dry matter, plants were harvested from second row on either side in each plot at 30, 60, 90, 120 and at harvest. On the basis of dry matter CGR and RGR were computed by using formulae given by Watson (1952).

Results and Discussion

Effect of genotypes

The crop growth rate (CGR) increased with the advancement of crop age upto 60-90 DAS (Table 1). This might be due to higher dry matter accumulation as well as production of more functional leaves (Saha and Mandal, 2000). Irrespective of genotypes and nitrogen levels, CGR in general showed a sigmoid pattern. Genotype RH-9707 had better CGR, though it was at par with RH-9304 at initial stages. Contrary to CGR, relative growth rates (RGR) attained maximum value between 30-60 DAS and gradually declined with the advancement of crop till maturity (Table 2). On the basis of two years, RH-9707 had maximum seed yield (1804.3 kg ha^{-1}) followed by RH-9304 (1771.4 kg ha^{-1}).

Effect of nitrogen

Each successive increase in nitrogen level from 0 to 80 kg/ha increased the CGR value at 30-60 and 60-90 days (Table 1). CGR decreased with the increase in nitrogen from 80 kg N/ha to 100 kg N/ha in first year and 60 kg/ha to 80 kg/ha in second year at 90-120 DAS. At 120-harvest, CGR was non-significant during first year, whereas, it increased from 0 to 60 kg N/ha. During the first year at 60-90 and 90-120 DAS nitrogen application didn't influenced the RGR, whereas, during second year it increased with nitrogen application from 0 to 60 kg at 60-90 DAS (Table 2). Application of 80 kg N/ha produced significantly higher seed yield (1964.2 kg/ha), which was 59.50 and 17.34% higher over control and 60 kg N/ha, respectively (Pooled over two years). Similar results have been reported earlier also(Singh and Singh, 1998).

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Table 1. Effect of genotypes and nitrogen levels on crop growth rate (g plant^{-1} day $^{-1}$) of Indian mustard

Treatments	Crop Growth Rate (g plant^{-1} day^{-1})											
	30-60 DAS			60-90 DAS			90-120 DAS			120-harvest		
	2002-03	2003-04	Mean	2002-03	2003-04	Mean	2002-03	2003-04	Mean	2002-03	2003-04	Mean
Genotypes												
RH-9304	0.359	0.371	0.365	1.163	1.185	1.174	0.273	0.397	0.355	0.265	0.112	0.189
RH-9324	0.341	0.348	0.345	1.110	1.127	1.119	0.326	0.288	0.307	0.118	0.092	0.105
RH-9404	0.318	0.332	0.325	1.041	1.041	1.028	0.372	0.427	0.400	0.058	0.044	0.051
RH-9505	0.303	0.323	0.313	0.933	1.098	1.016	0.235	0.443	0.339	0.156	0.079	0.118
RH-9510	0.316	-	0.316	0.926	-	0.926	0.485	-	0.485	0.117	-	0.117
RH-9512	0.236	0.282	0.259	1.153	1.018	1.086	0.219	0.308	0.264	0.203	0.069	0.136
RH-9610	0.276	-	0.276	0.906	-	0.906	0.173	-	0.173	0.165	-	0.165
RH-9707	0.349	0.354	0.352	1.138	1.231	1.185	0.390	0.327	0.359	0.311	0.273	0.292
LSD (P=0.05)	0.025	0.029		0.147	NS		0.078	0.095		0.055	0.031	
Nitrogen Levels												
0	0.208	0.257	0.233	0.598	0.521	0.560	0.227	0.297	0.262	0.151	0.091	0.121
60	0.322	0.329	0.326	0.985	1.169	1.077	0.292	0.426	0.359	0.181	0.116	0.149
80	0.353	0.374	0.364	1.244	1.327	1.286	0.363	0.396	0.380	0.187	0.121	0.154
100	0.367	0.380	0.374	1.343	1.449	1.396	0.355	0.341	0.348	0.177	0.118	0.148
LSD (P=0.05)	0.029	0.031		0.147	0.172		0.062	0.081		NS	0.019	

Table 2. Effect of genotypes and nitrogen levels on relative growth rate (mg g^{-1} day $^{-1}$) of Indian mustard

eatments	Crop Growth Rate (mg g^{-1} day^{-1})														
	30-60 DAS			60-90 DAS			90-120 DAS			120-harvest			Yield (Kg/ha)		
	2002-03	2003-04	Mean	2002-03	2003-04	Mean	2002-03	2003-04	Mean	2002-03	2003-04	Mean	2002-03	2003-04	Mean
Genotypes															
RH-9304	42.38	44.36	43.37	39.71	38.79	39.25	5.06	7.54	6.30	4.38	1.91	3.15	1615.9	1926.9	1771.4
RH-9324	42.11	42.43	42.27	39.29	38.36	38.83	6.25	6.00	6.13	2.22	1.66	1.94	1518.3	1759.2	1638.8
RH-9404	38.23	41.83	40.03	37.62	37.61	37.62	8.07	8.83	8.45	1.15	0.84	1.00	1531.6	1525.8	1528.7
RH-9505	38.40	41.95	40.18	36.18	39.38	37.78	5.29	8.90	7.10	3.77	1.39	2.58	1466.0	1696.7	1581.4
RH-9510	46.62	-	46.62	37.99	-	37.99	10.52	-	10.52	2.31	-	2.31	1432.4	-	1432.4
RH-9512	32.10	39.42	35.76	46.48	39.88	43.18	4.84	7.17	6.01	3.80	1.39	2.60	1455.8	1462.4	1459.1
RH-9610	43.62	-	43.62	40.60	-	40.60	4.16	-	4.16	4.41	-	4.41	1388.8	-	1388.8
RH-9707	41.77	41.81	41.79	39.75	40.10	39.93	7.59	6.21	6.95	4.28	4.23	4.26	1644.4	1964.1	1804.3
LSD P=0.05)	5.01	NS		2.87	NS		1.52	1.73		0.89	0.54		100.13	116.1	
Nitrogen levels (kg ha^{-1})															
0	46.47	54.13	50.30	38.54	32.07	35.31	7.55	10.19	8.87	4.62	2.55	3.59	912.8	678.3	795.6
60	41.21	38.12	39.67	38.52	40.87	39.70	6.12	7.73	6.93	3.32	1.77	2.55	1501.6	1745.8	1623.7
80	37.38	37.83	37.61	40.26	40.55	40.41	6.48	6.61	6.55	2.79	1.70	2.25	1769.9	2158.4	1964.2
100	37.55	37.77	37.66	41.48	42.58	42.03	5.80	5.23	5.52	2.44	1.59	2.02	17843.3	2307.6	2046.0
LSD (P=0.05)	3.08	3.61		NS	3.87		NS	1.73		0.72	0.38		159.59	211.2	