Indian J. of Agric. Res., 34 (4) : 271-274, 2000

PERIODICAL DRY MATTER ACCUMULATION OF *BRASSICAS* AS AFFECTED BY IRRIGATION AND NITROGEN LEVELS

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ABSTRACT

Field experiment was conducted during winter seasons of 1993-94 and 1994-95 to study the effect of irrigation and nitrogen levels on periodical plant height, number of primary branches and dry matter accumulation of *Brassica* species. Pooled data of two years showed that *Brassica* species RH-30, NPC-2 and HC-9001 recorded 178.5,238.3 and 229.2 cm plant height; 5.5, 10.3 and 10.1 number of primary branches and 45.92, 48.62 and 47.68 g dry matter per plant at harvest, respectively. Irrigation treatment I_2 (ID/CPE ratio of 0.5) had significantly more plant height, number of primary branches and dry matter accumulation over I_0 (no post-sowing irrigation) and I_1 (ID/CPE ratio of 0.25).Plant height, number of primary branches and dry matter accumulation per plant at harvest in I_2 treatment were 6.43 and 11.13, 11.31 and 16.15, and 17.42 and 20.98 per cent over I_1 and I_0 irrigation treatments, respectively. Plant height and dry matter accumulation increased significantly with successive increase in N levels upto 90 kg ha^{-1}. The number of primary branches increased significantly upto 60 kg ha^{-1}.

INTRODUCTION

In India, the non-traditional *Brassica* species, namely *Brassica napus* and *B. carinata* are likely to be preferred over traditional *B. juncea* as they have higher production potential (Fereres *et al.*, 1983). Little is known about behaviour of these *Brassica* species. The important measure of plant growth is dry matter accumulation, a product of several growth attributes like plant height, number of branches etc. The knowledge of variations in growth behaviour of *Brassica* species under different fertility and irrigation levels is essential to assess the consequences as these growth parameters have direct or indirect bearing on yield and productivity. Keeping these point in view, the present study was carried out to study the effect of fertilizer nitrogen and irrigation levels on relative performance of *Brassica* with respect to growth parameters *viz.* periodical dry matter accumulation, plant height and number of branches.

MATERIAL AND METHODS

Field experiment on *Brassica* species was conducted during the winter seasons of 1993-94 and 1994-95 at Agronomy Research Farm of CCS HAU, Hisar.The soil of the experimental field was sandy loam in texture, low in organic carbon (0.24%) and nitrogen (165 kg ha^{-1}), medium in phosphorus (13 kg P_2O_5ha^{-1}), high in potash (354 kg K_2O ha^{-1}) and (no post-sowing irrigation), I_1- irrigation at ID/CPE ratio of 0.25 (one irrigation) and I_2-irrigation at ID/CPE ratio of 0.5 (2/3 irrigation) in main plots and four nitrogen levels viz.0,30,60 and 90 kg N ha^{-1} in sub-plots. Full dose of N through urea as per treatments and basal dose of 40 Kg P_2O_5ha^{-1} through single super phosphate was applied at the time of sowing. Seed was sown in rows 30 cm apart on 26th and 27th October in 1993-94 and 1994-95, respectively in the same field during both the years. *B. juncea* cv. RH-30 was harvested on 18th and 20th March and *B. carinata* genotypes NPC-2 and HC-9001 were harvested on 12th and 14th April during 1993-94 and 1994-95, respectively.

For measuring plant height and number of primary branches per plant three plants in each plot were selected randomly and tagged. The height of the main shoot was measured from the cotyledonary nodes to the top of the shoot of the plant at each observation. Later on the same plants were used for counting number of primary branches per plant. For dry matter accumulation, three randomly selected plants from each plot were chopped and dried in sun for some time, thereafter, oven dried at 65°C for about 48 hours until a constant weight was attained and the average dry weight per plant

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Table 1: Effect of irrigation and nitrogen levels on periodical plant height (cm) of *Brassica* species.

Treatment	Days after sowing								
	30	45	60	75	90	105	120	135	At harvest
Cultivar/genotypes									
RH-30	6.3	46.5	83.3	126.3	154.5	165.3	173.6	178.3	178.5
NPC-2	5.4	23.4	46.9	89.1	156.2	197.2	224.2	232.1	238.3
HC-9001	4.9	20.8	40.4	77.6	149.1	192.0	213.4	223.5	229.2
C.D. at 5%	0.40	1.06	2.09	3.16	5.72	5.88	6.60	5.82	7.54
Irrigation levels									
I_0	5.5	29.1	54.3	94.1	144.9	177.5	196.5	202.3	204.7
I_1	5.5	29.3	54.5	94.4	146.0	181.5	200.2	207.8	213.8
I_2	5.6	32.2	61.7	104.5	168.8	195.7	214.8	223.8	227.5
C.D. at 5%	NS	NS	2.09	3.16	5.72	5.88	6.60	5.82	7.54
Nitrogen levels (Kg ha^{-1})									
0	5.0	22.7	43.9	79.4	134.9	172.0	184.7	191.3	194.4
30	5.4	28.7	55.4	94.8	152.2	186.1	202.8	211.3	215.7
60	5.7	33.3	62.4	106.1	159.9	193.2	211.5	218.9	222.7
90	6.0	36.2	65.8	110.3	165.9	197.4	216.0	224.1	228.1
C.D. at 5%	0.53	1.69	3.07	3.81	4.42	2.85	4.17	3.73	4.91

was recorded.

As the results of the two years were almost similar so the pooled data of two years are mentioned in the Tables.

RESULTS AND DISCUSSION

***Brassica* species** : Variation in plant height, number of primary branches and dry matter accumulation per plant were recorded in *Brassica* species at various crop growth stages (Table 1, 2 & 3). The differences in growth parameters in *Brassica* species might be due to the differences in their genetic constitution. These findings are in confirmation with those of Fereres (1983) and Singh (1992) who have also reported great genotypic variations in plant height, number of branches and dry matter accumulation in *Brassica* species.

Plant height increased with successive stages of crop growth increasing at maximum rate between 60 to 75 days in *B. juncea* cv. RH-30 and between 75 to 90 days in *B. carinata* genotypes NPC-2 and HC-9001. The pooled data of two years showed that plant height of *Brassica* species varied significantly at various growth stages. However, at harvest genotype NPC-2 recorded maximum plant height (238.3 cm) followed by genotypes HC-9001 (229.2 cm) and cultivar RH-30 (178.5 cm) in descending order (Table 1).

Number of primary branches per plant for different *Brassica* species (Table 2) revealed that

Table 2 : Effect of irrigation and nitrogen levels on periodical number of primary branches per plant of *Brassica* species

Treatment	Days after sowing						
	60	75	90	105	120	135	At harvest
Cultivars/genotypes							
RH-30	3.6	4.8	5.1	5.3	5.4	5.5	5.5
NPC-2	1.5	4.4	8.3	9.8	10.0	10.2	10.3
HC-9001	1.4	4.2	8.2	9.7	9.9	10.0	10.1
C.D. at 5%	0.21	0.36	0.41	0.51	0.58	0.70	0.70
Irrigation levels							
I_0	2.0	4.3	6.9	7.9	8.0	8.0	8.0
I_1	2.0	4.3	6.9	8.0	8.1	8.3	8.4
I_2	2.3	4.8	7.8	8.8	9.0	9.2	9.3
C.D. at 5%	0.21	0.36	0.41	0.51	0.58	0.70	0.70
Nitrogen levels (kg ha^{-1})							
0	1.8	3.9	6.3	7.1	7.2	7.3	7.3
30	2.2	4.5	7.2	8.2	8.4	8.6	8.7
60	2.3	4.7	7.6	8.8	8.9	9.1	9.2
90	2.4	4.8	7.8	9.0	9.1	9.2	9.2
C.D.at 5%	0.06	0.17	0.30	0.37	0.43	0.46	0.46

the number of primary branches per plant increased upto 135 DAS in RH-30 and upto harvest in NPC-2 and HC-9001. *B. juncea* cv. RH-30 recorded significantly more number of primary branches upto 75 DAS over both the genotypes NPC-2 and HC-9001 of *B. carinata*, but later on the trend became reverse upto the harvest. The differences between NPC-2 and HC-9001 were not significant.

A close perusal of the data (Table 3) indicates that the dry matter accumulated at a slow rate upto 30 DAS, and thereafter the dry matter accumulation was rapid between 45 to 105 DAS in *B. carinata* (Genotypes NPC-2 and HC-9001) and between 45 to 90 DAS in

Table 3 : Effect of irrigation and nitrogen levels on periodical dry matter accumulation (g/plant), stover and seed yield of *Brassica* species

Treatment	Days after sowing										
	30	45	60	75	90	105	120	130	At harvest	Seed yield (Q ha^{-1})	Stover yield (Q ha^{-1})
Cultivars/genotypes											
RH-30	2.19	6.24	13.31	22.79	33.43	39.81	42.43	44.80	45.92	14.15	34.44
NPC-2	1.29	2.87	7.70	15.29	25.36	36.56	42.47	45.41	48.62	13.59	41.34
HC-9001	1.27	2.77	7.57	15.17	25.96	36.47	41.83	44.58	47.68	13.50	40.83
C.D. at 5%	0.13	0.25	0.63	2.11	2.83	2.29	NS	NS	NS	NS	4.17
Irrigation levels											
I_0	1.58	3.84	9.25	16.73	26.67	35.29	39.68	41.91	43.89	11.81	33.65
I_1	1.58	3.90	9.30	16.75	26.76	35.44	39.89	42.43	45.22	12.51	36.56
I_2	1.60	4.15	10.03	19.76	31.31	42.09	47.15	50.44	53.10	16.74	46.40
C.D. at 5%	NS	NS	0.63	2.11	2.83	2.29	2.33	3.01	3.26	1.86	4.17
Nitrogen levels (Kg ha^{-1})											
0	1.23	3.11	7.42	13.58	22.11	30.06	33.63	35.32	36.96	9.15	28.94
30	1.54	3.85	9.39	17.22	27.37	36.60	41.04	43.50	46.43	13.00	36.91
60	1.73	4.29	10.34	19.53	30.77	40.65	45.76	48.89	51.67	15.72	43.29
90	1.85	4.58	10.96	20.67	32.74	43.14	48.54	52.00	54.38	16.87	46.35
C.D. at 5%	0.07	0.22	0.57	1.00	1.83	1.50	1.55	1.61	1.81	1.02	2.58

B.juncea (cv. RH-30) and declined thereafter. Cultivar RH-30 produced significantly more dry matter over genotypes NPC-2 and HC-9001 upto 105 DAS. Thereafter, no significant difference in dry matter accumulation per plant was recorded amongst the Brassica species till crop harvest. Genotype NPC-2 and HC-9001 did not differ significantly for dry matter accumulation at all the stages of crop growth. *Brassica* species RH-30, NPC-2 and HC-9001 produced seed yield at par. Genotypes NPC-2 and HC-9001 did not differ between themselves but produced significantly higher stover yield over cultivar RH-30 (Table 3).

Irrigation effect : With the increase in frequency/numbers of irrigation there was increase in plant height, number of primary branches and dry matter accumulation per plant (Table 1, 2 & 3). The pooled data for two years showed that irrigation treatments did not affect the plant height upto 45 days of crop age. However, at subsequent crop growth stages, irrigation treatment I_2 had significantly more height over I_0 and I_1 upto harvest, however, I_0 and I_1 were statistically at par at all the growth stages except at harvest, where the differences were recorded significant. At harvest treatments I_2, I_1 and I_0 recorded plant height of 227.5, 213.8 and 204.7 cm, respectively. Irrigation treatment I_2 recorded significantly more number of primary branches per plant over I_0 and I_1, however, the later two treatments were statistically at par at all the growth stages. At harvest, the number of primary branches produced per plant in I_2, I_1 and I_0 treatments were 9.3, 8.4 and 8.0, respectively (Table2). After 45 days crop growth stage, the dry matter accumulation was significantly higher in I_2 than I_0 and I_1 irrigation treatment at all the crop growth stages. The differences between I_0 and I_1 were non-significant (Table 3).

Based on two years average increase in plant height, number of primary branches and dry matter accumulation per plant at harvest in I_2 were 6.43 and 11.13, 11.31 and 16.15, and 17.42 and 20.98 per cent over I_1 and I_0 irrigation treatments, respectively. The lower dry matter accumulation in I_0 and I_1 level of irrigation might be due to poor development of leaves, branches and plant height. Khan and Agarwal (1988) have reported corroborative findings. Irrigation treatments, I_2 significantly influenced that seed and stover yield over treatments I_0 and I_1, however, the treatments I_0 and I_1 were statistically at par (Table 3).

Nitrogen effect : Increasing N levels resulted in taller plants, more number of branches and higher dry matter accumulation (Table 1, 2 & 3) perhaps due to the fact that nitrogen supply resulted into increased conversion of carbohydrates into protein which in turn elaborated into protoplasm. The favourable effect of nitrogen on protoplasm and cell wall material increased the size of the cell, which expressed

morphologically in terms of increased plant height, number of branches and ultimately the dry matter accumulation. The present findings are in accordance with those of Bhardwaj (1991) and Singh (1992). Application of nitrogen up to 90Kgha^{-1} significantly increased the seed and stover yield (Table 3).

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