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RATE AND PATTERN OF GROWTH IN PHYSIOLOGICAL PARAMETERS AS AFFECTED BY SPACING AND VARIETIES IN BROAD LEAF MUSTARD (*Brassica funcea* var. *regosa* Roxb. Tsen and Lee)

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ABSTRACT

Field experiments were conducted during the *rabi* seasons of 1996-97 and 1997-98 at Horticultural Farm, Central Agricultural University, Imphal. Among the 3 varieties, Hanggam Angoubi and Hanggam Anganbi performed better in all the physiological growth parameters considered. Closer spacing recorded higher LAI and LAR but lowr RGR and NAR irrespective of year and stages. All the physiological growth characters except LAI decreased progressively with the advancement of time

INTRODUCTION

Grwth analysis is an important tool in identifying the causes of yield variation. Selection of suitable variety and maintenance of optimum plant density will help in better harvest of the solar energy and efficient utilization of there inputs, thereby, providing progressive changes in the morphology of the plant. Hence, it becomes imperative to evaluate the growth behaviour of this leafy vegetable as influence by variety and spacing.

MATERIAL AND METHODS

The field invetigation was carried out at horticultural farm, College of Agriculture, Central Agricultural University, Imphal during the *rabi* season of 1996-97 and 1997-98. The soil was clay in texture having a pH of 5.3 during both the years. The treatments consist of 3 varieties (Hanggam Amubi (V1) Hanggam Angoubi (V2) and Hanggam Anganbi (V3) and 7 spacings S1 = 66.6 x 66.6 cm, S2 = 50 x 50 cm, S3 = 50 x 40 cm, S4 = 40 x 40 cm, S5 = 50 x 25 cm, S6 = 40 x 25 cm, S7 = 25 x 25 cm), replicated three times in a factorial randomized block design. Single seedling of 26-27 days old was transplanted on 19th Nov., 1996 and 1997. The biometric observations for calculating the LAI, LAR, RGR and NAR were done at an interval of 15 days starting from 20 days after transplanting (DAT). The leaf area method developed by Meitei et al (1998) was followed.

RESULTS AND DISCUSSION

Leaf area Index (LAI)

Significantly highest LAI was produced with the closest spacing (Table 1) which might be

due to more number of plants per unit area possessing more photosynthetic surface so that all the space might have been completely covered by the plants. The lowest LAI was recorded with the widest spacing of 66.6 x 66.6 cm. These findings are also in agreement with that of Kulia et al. (1992) in *Brassica juncea* var. Varuna. The highest LAI was recorded with the variety Hanggam Angoubi which is due to possessing more leaf area per plant.

Leaf area ratio (LAR)

The LAR decreased with the advancement of time and recorded minimum at last sampling (65 DAT) for all the treatments. The highest LAR was indicated by the closest spacing (S7) and the lowest LAR with the widest spacing (S1). The different varieties could not bring any significant influence on the LAR (Table-2).

Relative growth rate (RGR)

RGR decreased with the advancement of period where the widest spacing and the variety Haggam Anganbi recorded maximum RGR during the early stage. However, there was no significant responses for spacing and variety on RGR at the later stages for both the experiments (Table 3). This result is also in confirmity with the findings of Kumar and Gangwar (1985) in rape seed.

Table I . Effect of spacing and variety on leaf area index (LAI) and ent assimilation rate (NAR) of broad leaf mustard (pooled mean).

Treatment	LAI				NAR (g/day)		
	Days after transplanting						
	20	35	50	65	20-35	35-50	50-65
Variety							
Vl	0.61	1.48	1.57	2.04	0.27	0.18	0.12
V2	0.69	1.56	1.88	2.47	0.29	0.21	0.13
V3	0.67	1.35	1.39	-	0.29	0.21	-
C.D. at 5%	0.02	0.04	0.02	0.03	0.02	0.03	NS
Spacing							
S1	0.63	1.22	1.32	1.61	0.39	0.24	1.13
S2	0.64	1.30	1.45	1.72	0.33	0.23	0.15
S3	0.64	1.40	1.55	1.80	0.31	0.19	L.14
S4	0.67	1.44	1.60	1.91	0.28	0.19	0.13
S5	0.68	1.61	1.77	2.06	0.23	0.17	0.11
S7	.68	1.74	1.86	2.25	0.21	0.16	0.10
C.D. at 5%	0.03	0.06	0.03	0.05	0.04	0.05	NS

Table 2. Effect of spacing and variety on leaf area ratio (LAR) of broad leaf mustard.

Treatment	LAR (cm^2/g) days after transplanting (DAT)							
	1996-97				1997-98			
	20	35	50	65	20	35	50	65
Variety								
V1	0.34	0.26	0.23	0.16	0.36	0.23	0.20	0.17
V2	0.35	0.24	0.19	0.15	0.31	0.24	0.21	0.18
V3	0.46	0.26	0.19	-	0.38	0.24	0.19	-
C.D. at 5%	0.03	NS	0.02	0.01	0.04	NS	Ns	NS
Spacing								
S1	0.34	0.21	0.14	0.14	0.30	0.19	0.16	0.16
S2	0.39	0.22	0.19	0.16	0.29	0.20	0.16	0.13
S3	0.36	.25	0.20	0.14	0.34	0.23	0.19	0.16
S4	0.38	.25	0.22	0.17	0.34	0.24	.20	0.18
S5	0.39	0.28	0.22	0.16	0.35	0.27	0.23	0.19
S6	0.40	0.27	0.23	0.17	0.38	0.26	0.23	0.21
CD at 5%	NS	0.25	0.04	0.01	0.06	0.02	0.04	0.03

Table 3. Effect of spacing and variety on relative growth rate (RGR) of broad leaf mustard

Treatment	RGR (g/day) days after transplanting (DAT)					
	1996-97			1997-98		
	20-35	35-50	50-65	20-35	35-50	50-65
Variety						
V1	0.06	0.03	0.02	0.08	0.03	0.02
V2	0.07	0.04	0.02	0.07	0.03	0.03
V3	0.07	0.03	-	0.07	0.04	-
CD at 5%	0.01	NS	NS	0.01	NS	NS
Spacing						
S1	0.09	0.04	0.03	0.09	0.04	0.03
S2	0.08	0.04	0.02	0.08	0.04	0.03
S3	0.07	0.04	0.03	0.08	0.03	0.03
S4	0.07	0.03	0.02	0.07	0.03	0.02
S5	0.06	0.03	0.03	0.06	0.03	0.02
S6	0.05	0.03	0.01	0.06	0.03	0.02
S7	0.05	0.03	0.01	0.06	0.03	0.02
CD at 5%	0.01	NS	NS	NS	NS	NS

Net assimilation rate (NAR)

The data presented in Table I indicate the maximum NAR at the earlier phase of growth with the spacing 66.6 x 66.6 cm (S1). However, at 50-65 DAT all the spacings could not influence the NAR significantly. Similar result was also reported by Kumar and Gangwar (1985) in rape seed. The variety Haggam Angoubi (V2) and Hanggam Anganbi (V3) did not differ significantly in NAR at the earlier two stages.

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