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Variability in Wheat for Grain Growth Rate Under Timely and Late Sowing

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ABSTRACT

Fifteen varieties of different height and maturity were grown on 15th November (Timely) and 30th November (Late) 1981 in randomized block design with three replications to study the variability for grain growth rate. Average grain growth rate (mg/spike/day) was studied from first to eight weeks after anthesis in timely and late sowing. Considerable useful variability for grain growth rate during first four weeks from anthesis was noticed. Third week in timely and second week in late sowing registered highest grain growth rate. Grain growth rate of all the varieties reduced in late sowing due to prevailing high temperatures. Lok 1, WH 147, HI 784, Kalyansona and HJ 74-27 were found to possess initial high grain growth rate which may be exploited in breeding varieties for late sowing.

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INTRODUCTION

Character association studies in wheat have clearly brought out spike number per unit area and grain weight per spike as the most important yield components (Saini 1978). While number of spike per unit area depends upon tillers production and their survival. The grain weight per spike is the function of rate of grain growth (rate of dry matter accumulation in grains) and length of grain filling period. The total dry matter accumulation during grain filling period is affected where the crop has to mature under increasing temperatures. Thus the rate of grain growth per unit time plays very important role in deciding final grain yield of late sown crop. Pinthus and Sar-Shalom (1978) reported that differences in grain weight of cultivars were associated with differences in rate rather in duration of dry matter accumulation in grains. Present study was, therefore, undertaken to study grain growth rate in fifteen diverse wheat varieties under normal and late sowing.

MATERIALS AND METHODS

Fifteen varieties selected from different height and maturity groups were planted in randomized block design with three replication on 15th November (timely sowing) and 30th November (late sowing) 1981 at Wheat

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Research Station, Junagadh. Five meters long six rows at 25 cm distance having plant to plant distance 10 cm were allotted to each variety. Recommended cultural practices including fertilizer appliaction were followed uniform. Prophylaetic measures were followed to prevent the infection of diseases specially leaf rust. Average grain growth rate (mg/spike/day) was measured during first to eight weeks from anthesis as per procedure adopted by Wattal and Asana (1976). The possible differences in grain growth rate which may be associated with the position of grains in the spikelet or with spikelet position in the spike were ignored and the average grain growth rate per spike was measured.

RESULTS AND DISCUSSION

The analysis of variance for average grain growth rate during first to eight weeks from anthesis in timely and late sowing (Table 1) revealed highly significant differences amongst wheat varieties. Weekly grain growth rate i.e. between weeks was also significant indicating that grain growth rate was different during different weeks after anthesis. Varieties differed significantly in their grain growth rate throughout grain filling period as mean sum of square for all the weeks were significant. Sum of square due to grain growth rate during different weeks and their contribution to the sum of square due to total grain growth rate indicated that varieties exhibited maximum variability during third and second week in timely and second and first week in late sowing. The present findings are in agreement with those of Anonymous (1972) and Pinthus and Sar-Shalom (1978).

TABLE 1

Analysis of variance for average grain growth rate (mg/spike/day) during grain filling under timely (D_1) and late (D_2) sowing of wheat.

Source of variance	*d.f.*	*M.S.*	
		D_1	D_2
Replication within weeks	16	4.64	3.09
Grain growth rate (individual sample)	119	3856.87*	1720.57*
Varieties within first week	14	586.19*	429.43*
Varieties within second week	14	1337.78*	1066.60*
Varieties within third week	14	1770.04*	315.41*
Varieties within fourth week	14	423.30*	153.49*
Varieties within fifth week	14	254.85*	41.28*
Varieties within sixth week	14	130.85*	38.14*
Varieties within seventh week	14	13.21*	5.90*
Varieties within eighth week	14	0.59*	0.53*
Between weeks	7	46573.25*	25148.08*
Error for first to fifth week	140	22.34	8.55
Error for sixth week	28	2.41	1.74
Error for seventh week	28	0.20	0.19
Error for eighth week	28	0.02	0.5
Error (Pooeld)	224	14.29	5.59

*Significant at 1% level.

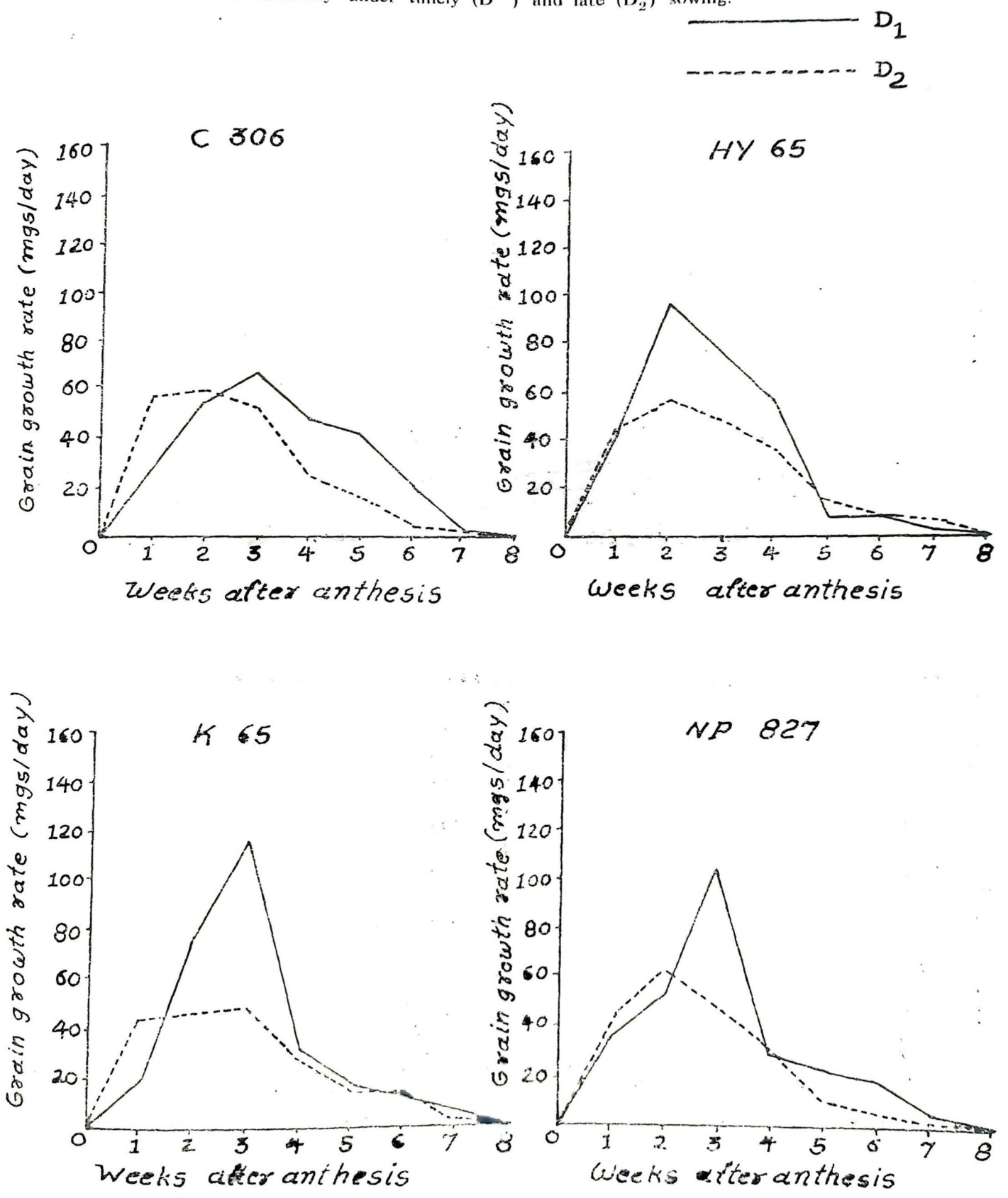
TABLE 2

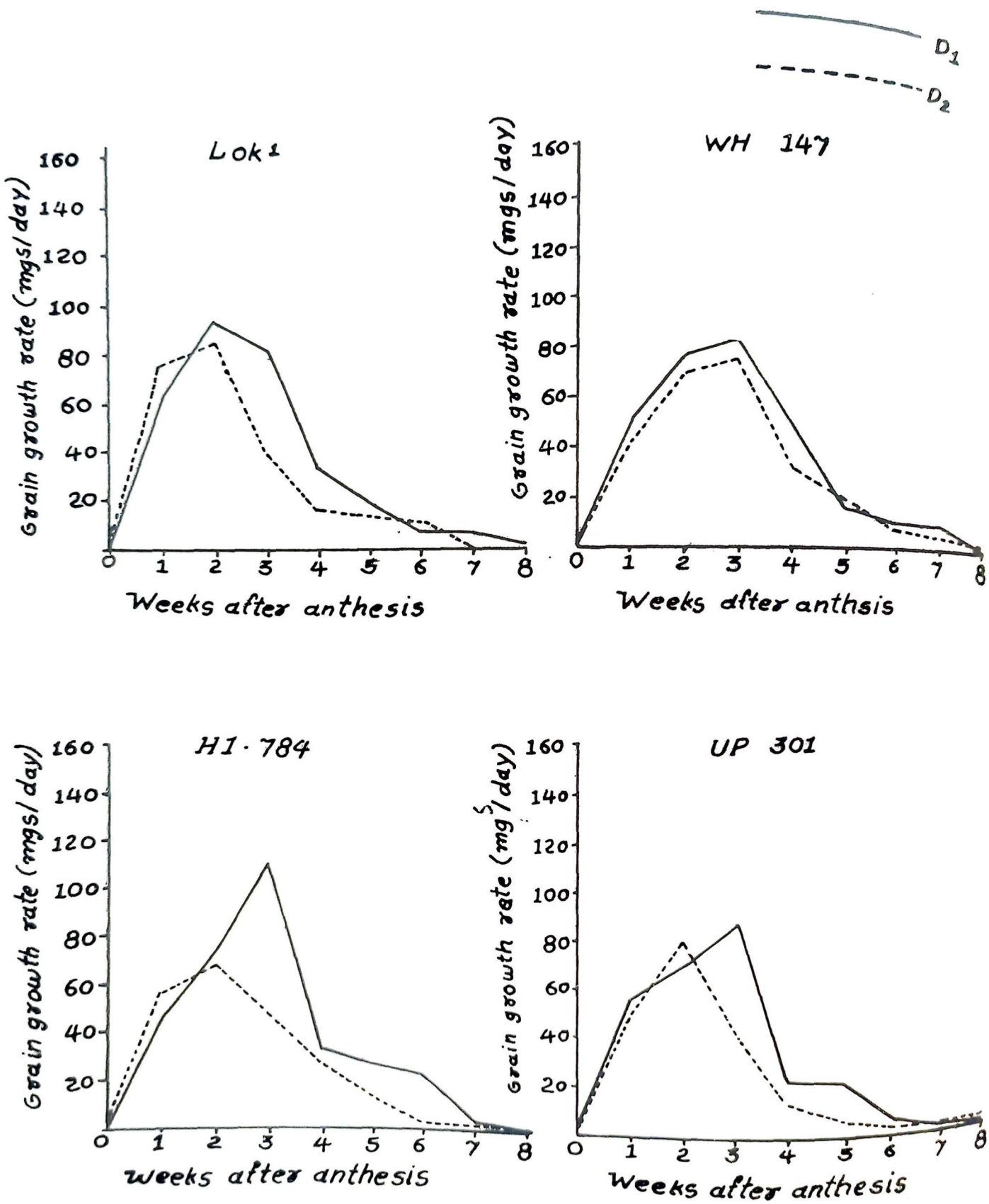
Average grain growth rate (mg/spike/day) of fifteen varieties of wheat under timely and late (Paranthesis) sowing.

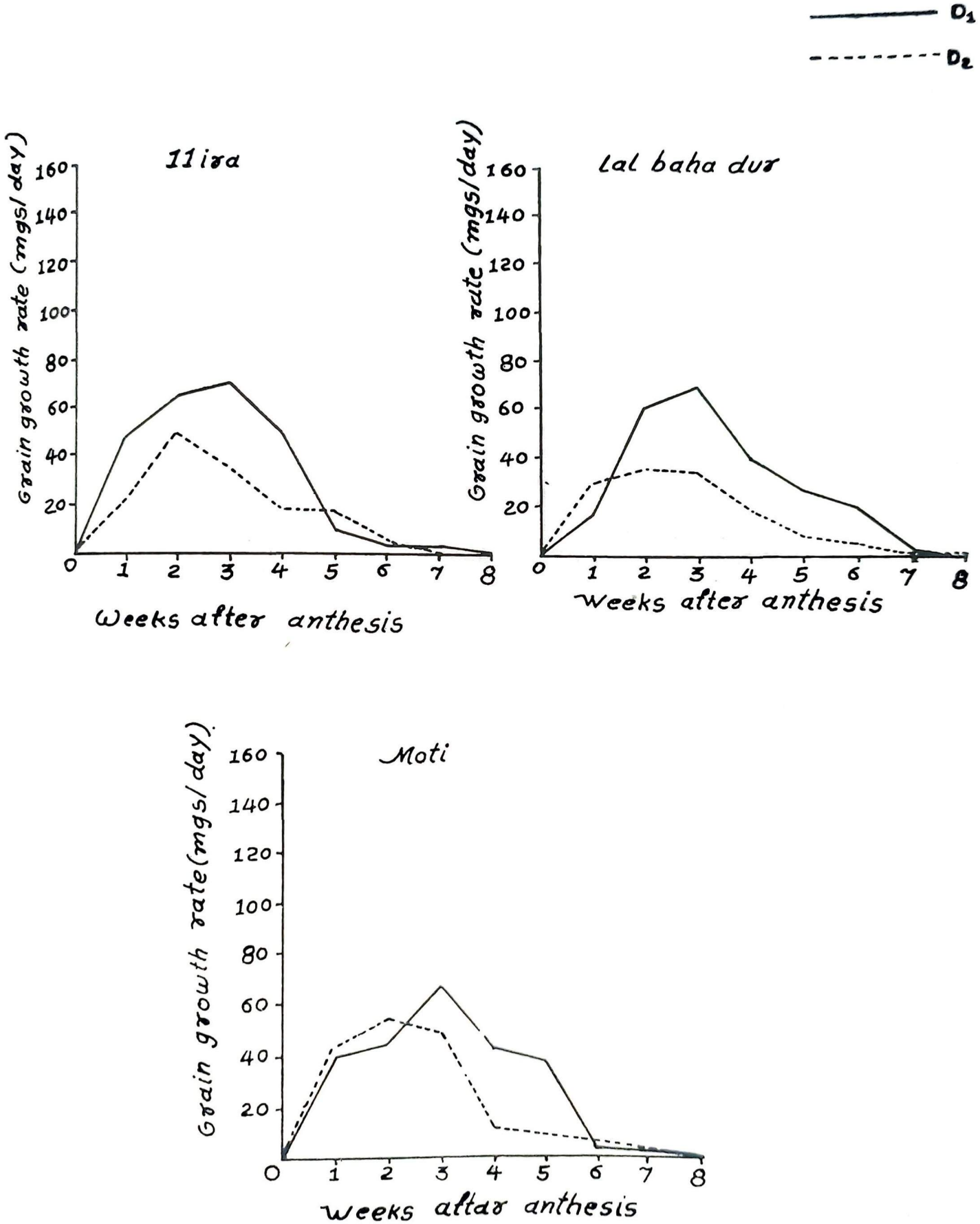
Sr. No.	*Name of variety*	*Weeks after anthesis*								*Average*
		First	*Second*	*Third*	*Fourth*	*Fifth*	*Sixth*	*Seventh*	*Eighth*	
1	2	3	4	5	6	7	8	9	10	11
1.	C 306	27.26	54.62	65.67	47.83	41.36	19.95	2.64	0.56	32.49
		(55.71)	(59.05)	(51.74)	(24.31)	(16.41)	(4.94)	(0.84)	(0.71)	(26.72)
2.	Hy 65	43.16	96.67	75.71	56.96	8.88	8.40	4.14	1.21	36.86
		(43.95)	(57.10)	(48.07)	(35.70)	(13.67)	(7.63)	(5.74)	(1.65)	(26.61)
3.	K 65	18.57	75.71	114.76	32.44	16.90	14.44	4.86	1.14	34.85
		(44.05)	(45.57)	(48.69)	(28.22)	(15.70)	(14.90)	(3.52)	(1.34)	(25.30)
4.	NP 824	36.19	53.55	105.24	29.05	22.86	18.52	4.52	0.71	33.80
		(43.33)	(62.05)	(48.53)	(29.74)	(10.76)	(4.96)	(2.48)	(1.59)	(25.42)
5.	Narbada 4	24.29	47.15	118.57	62.86	17.67	3.52	0.86	0.18	34.39
		(40.20)	(48.46)	(55.87)	(24.21)	(18.79)	(5.16)	(1.66)	(0.98)	(23.53)
6.	J 17	19.06	80.48	89.52	34.37	29.91	16.50	1.64	1.47	34.12
		(38.48)	(52.38)	(48.71)	(25.95)	(11.06)	(10.34)	(2.49)	(0.77)	(23.78)
7.	HJ 74-27	34.19	59.05	146.67	25.38	12.43	10.57	1.21	0.23	36.22
		(45.19)	(61.80)	(46.95)	(17.05)	(12.87)	(4.24)	(1.94)	(0.98)	(23.88)
8.	Kalyansona	32.39	122.86	64.76	27.63	20.05	15.00	2.07	1.57	35.80
		(44.84)	(110.23)	(33.06)	(17.86)	(8.69)	(1.83)	(1.16)	(0.81)	(27.31)
9.	Lok 1	62.39	92.86	81.91	35.80	18.10	8.24	4.86	1.14	37.90
		(75.35)	(84.57)	(40.26)	(16.16)	(13.06)	(8.95)	(1.38)	(0.19)	(30.00)

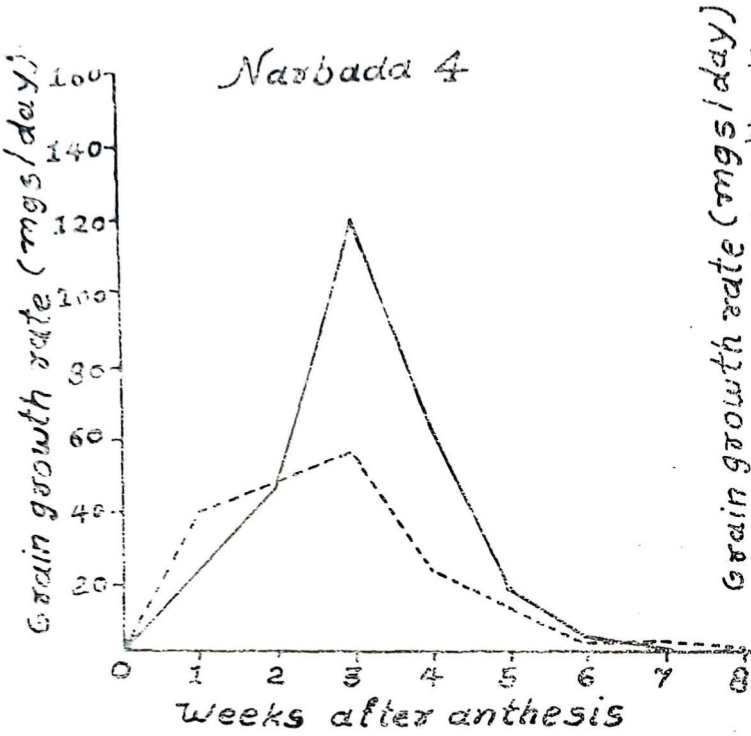
1	2	3	4	5	6	7	8	9	10	11
10.	WH 147	49.15 (42.83)	76.19 (70.21)	83.05 (75.10)	47.46 (31.71)	16.36 (17.93)	9.86 (7.93)	8.52 (4.66)	1.29 (1.49)	36.48 (31.48)
11.	HI 784	46.66 (55.90)	72.86 (67.83)	109.52 (46.49)	32.81 (27.66)	25.80 (12.94)	22.34 (1.81)	2.93 (1.67)	0.64 (0.48)	39.20 (26.73)
12.	UP 301	55.71 (50.90)	70.49 (81.48)	87.15 (43.34)	22.37 (13.10)	21.20 (5.49)	5.07 (2.21)	0.50 (1.33)	0.40 (0.51)	32.86 (24.80)
13.	Hira	46.51 (22.38)	63.81 (47.52)	68.57 (34.71)	49.05 (18.77)	10.01 (16.94)	2.54 (5.95)	1.64 (1.12)	0.86 (0.17)	30.37 (18.45)
14.	Lalbahadur	16.45 (30.10)	60.96 (35.10)	68.15 (34.09)	40.33 (19.48)	26.10 (7.50)	19.34 (4.93)	2.12 (1.24)	0.43 (0.84)	29.23 (16.66)
15.	Moti	40.96 (43.05)	43.86 (54.24)	67.14 (48.37)	42.38 (11.50)	36.67 (7.83)	4.29 (4.98)	1.93 (2.01)	0.73 (1.02)	29.74 (21.63)
16.	Average	36.82 (45.09)	71.38 (62.30)	89.77 (49.93)	38.98 (22.79)	21.62 (12.12)	11.88 (5.92)	2.96 (2.22)	0.82 (0.86)	34.29 (24.82)
	C.D. at 5%	8.19 (5.17)	7.80 (6.44)	10.85 (6.13)	6.36 (4.20)	4.60 (2.42)	2.60 (2.21)	0.76 (0.73)	0.28 (0.38)	1.90 (1.35)

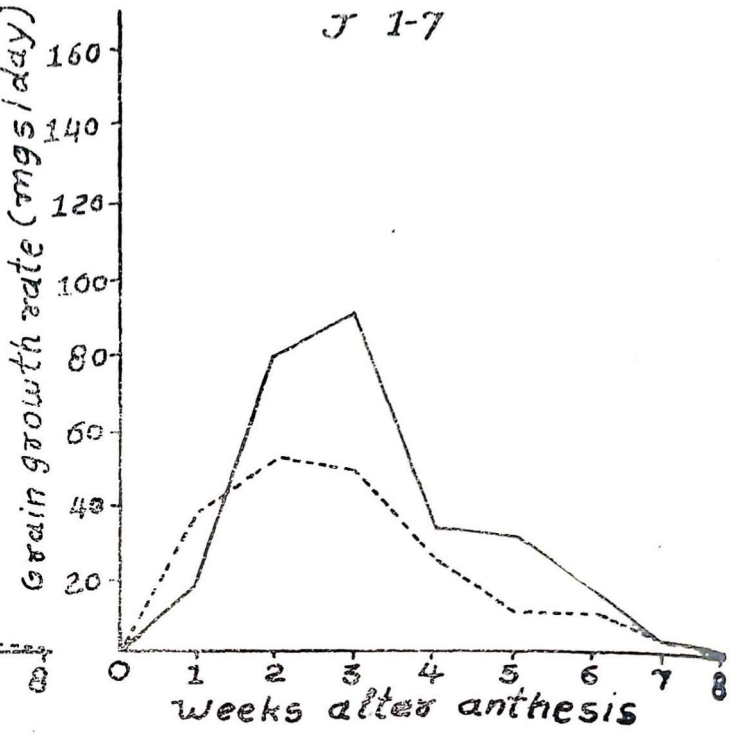
Figure 1. Average grain growth rate in different varieties of wheat during different weeks from anthesis to maturity under timely (D_1) and late (D_2) sowing.

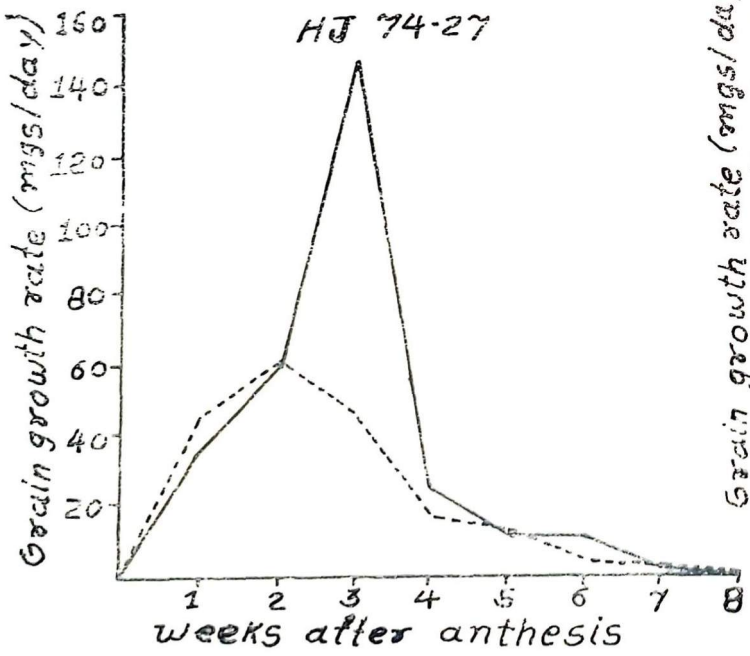


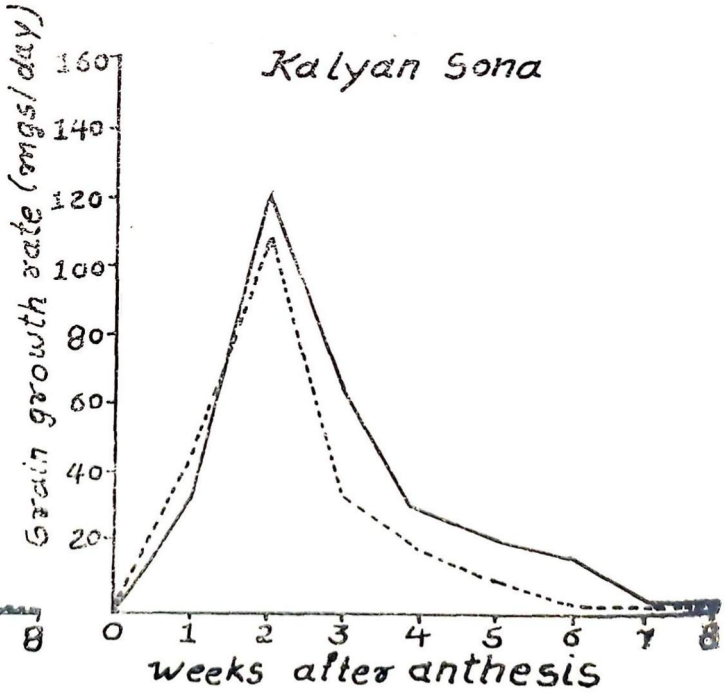

D1
D2
Lok 1
WH 147
HI · 784
UP 301
Grain growth rate (mgs/day)
Weeks after anthesis
0 1 2 3 4 5 6 7 8
20 40 60 80 100 120 140 160


D1
D2
11ira
lal baha dur
Moti
Grain growth rate (mgs/day)
Weeks after anthesis
0
1
2
3
4
5
6
7
8
20
40
60
80
100
120
140
160


Narbada 4
Grain growth rate (mgs/day)
160
140
120
100
80
60
40
20
0 1 2 3 4 5 6 7 8
Weeks after anthesis


J 1-7
Grain growth rate (mgs/day)
160
140
120
100
80
60
40
20
0 1 2 3 4 5 6 7 8
Weeks after anthesis


HJ 74-27
Grain growth rate (mgs/day)
160
140
120
100
80
60
40
20
1 2 3 4 5 6 7 8
weeks after anthesis


Kalyan Sona
Grain growth rate (mgs/day)
160
140
120
100
80
60
40
20
0 1 2 3 4 5 6 7 8
weeks after anthesis

Garin development is reported to be affected adversely by high temperatures prevailing during grain filling (Asana & Williams 1965, Wattal 1965). The weekly grain growth rate of all the verieties (Table 2) during late sowing was lower as compared to timely sowing as the grain filling in late sowing expeneced higher temperatures. Also the coefficients of correlation between weekly grain growth rate and prevailing maximum temperatures during corresponding week for all the fifteen varieties were negative (values ranges from -0.50 to -0.87). This indicated that grain growth rate was reduced in late sowing due to prevailing high temperatures. Quick grain filling at higher rate will give comparatively higher yield under late sowing. Analysis of weekly average grain growth rate of individual varieties (Table 2) revealed that Lok 1 had the highest grain growth rate during first week and the second highest during second week in both timely and late sowing. Kalyansona during second week in timely and late sowing and HJ 74-27 in timely and WH 147 in late sowing during third week registered the highest grain growth. HI 784 also had high grain growth in second and third week. These varieties with high initial growth rate have given higher yield in different trials under high temperature conditions of central zone. Lok 1 and WH 147 gave very high yield in all India coordinated trials under short growing season of central zone and have been recommended for general cultivation. The varieties adapted to rainfed conditions like C-306, Hy 65, K 65 and Narbada 4 had comparatively low initial grain growth followed by constant increase in rate upto 3-4 weeks of anthesis. Under rainfed conditions the wheat is sown early to take advantage of residual moisture and, therefore, avail longer reproductive phase. The dwarf varieties like Hira, Moti, and Lalbahadur did not show much improvement in grain growth rate during first four weeks which are important from grain filling point of view. This indicated that these varieties will not fit in short growing season.

Wheat crop in Gujarat matures under gradual increasing temperatures in the month of February-March. Therefore, a variety with initial high grain growth rate is needed in order to get higher yields. The present study revealed large amount of variability for grain growth rate during first four weeks of anthesis which are potential weeks from grain filling point of view. Also, some varieties like Lok 1, WH 147, Kalyansona, HJ 74-27 and HI 784 were identified to possess initial high grain growth rate which may be exploited in breeding programmes.

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