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Influence of sowing date on phase duration and accumulation of dry matter in spikes of wheat (*Triticum aestivum*)

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ABSTRACT

A field experiment was conducted during the winter (*rabi*) season of 1987–88 and 1988–89 to study the effect of sowing date on phase duration and dry-matter accumulation of 10 genotypes of wheat (*Triticum aestivum* L. emend. Fiori & Paol.). Late-sown crop had heavier spikes than timely sown one at anthesis; however, final spike-dry weight was lower in late-sown crop. The normal-sown crop continued to accumulate dry matter at later stages also. There was a reduction in the total life-span of the crop when sowing was delayed and the longest period of ear growth was available to normal-sown crop.

Numerous environmental and genotypic variables interact over the long period of growth of wheat (*Triticum aestivum* L. emend. Fiori & Paol.) crop in determining the magnitude of any quantitative character. Late-planted crop faces high temperature during ripening phase. The rate of dry-matter accumulation remains faster at higher temperature than at lower temperature. Spike dry weight increases due to the deposition of grain protein and carbohydrates, which is partially on the expense of assimilate transfer from stem and root (Campbell and Davidson, 1979). Hence it is desirable to study the effect of late sowing, as reflected by variations in temperature, on duration of various growth stages and dry-matter accumulation in spike of wheat.

MATERIALS AND METHODS

The field experiment was conducted during the winter season of 1987–88 and 1988–89 at Pantnagar. The treatments comprising 4 sowing dates in each year (15 November, 5 and 25 December, and 15 January during 1987–88 and 2 and 17 December, and 18 and 28 January during 1988–89) and 10 genotypes ('UP 1177', 'UP 1179', 'UP 2275', 'UP 2276', 'UP 1182', 'UP 1183', 'UP 2243', 'UP 2283', 'UP 2285' and 'Sonalika'), replicated thrice, were laid out in split-plot design with sowing dates in main plots and genotypes in subplots. The soil was silty loam containing organic carbon 1.06%, available P 27.75 and 24.09 kg/ha and available K 135.29 and 133.63 kg/ha during 1987–88 and 1988–89 respectively, with pH 7.1. The rainfall received during crop

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Table 1. Effect of sowing dates and varieties on phase duration of the wheat crop during 1987–88 and 1988–89.

Treatment	Days taken to				Days taken to			
	75% booting	75% heading	Physiological maturity	75% heading to maturity	75% booting	75% heading	Physiological maturity	75% heading to maturity
Sowing date								
1987–88 1988–89								
15 Nov. 2 Dec.	78.90	89.00	139.80	50.80	82.06	88.36	137.56	49.20
5 Dec. 17 Dec.	70.40	80.03	130.80	50.60	75.96	83..33	130.46	47.13
25 Dec. 18 Jan.	62.33	69.86	108.96	39.23	64.73	70.80	110.46	39.63
15 Jan. 28 Jan.	53.00	59.10	89.06	29.90	59.73	65.56	102.30	37.26
CD (P = 0.05)	1.33	2.49	1.28	1.85	2.04	1.74	1.49	1.22
Variety								
'UP 1177'	67.66	75.91	119.00	43.00	71.25	76.91	119.83	42.91
'UP 1179'	69.58	78.41	119.58	41.33	72.16	78.00	122.25	44.08
'UP 2275'	71.00	80.25	120.91	40.66	72.16	78.66	123.08	44.41
'UP 2276'	59.33	67.58	110.58	43.08	69.33	74.91	117.16	42.33
'UP 1182'	70.50	78.41	121.66	43.25	73.33	80.16	126.00	45.91
'UP 1183'	74.91	82.58	126.58	44.00	76.58	84.00	129.08	45.08
'UP 2243'	59.50	67.75	110.25	42.50	67.33	73.66	115.66	42.00
'UP 2283'	64.58	73.16	116.33	43.16	69.00	76.08	120.16	44.08
'UP 2285'	65.58	73.91	116.83	42.91	68.75	75.25	118.50	43.25
'Sonalika'	58.91	67.00	109.25	42.41	66.33	72.50	111.50	39.00
CD (P = 0.05)	1.15	1.59	1.36	1.33	0.97	0.91	1.17	1.05

season of 1987–88 and 1988–89 was 83.0 and 85.1 mm respectively. For recording the days taken to different physiological stages, 2 m-row length was marked. Number of shoots showing the particular stage was counted on alternate days, starting from the day when 5 such shoots were seen till the number became constant. Days taken by 75% shoots to show the stage was calculated. For the calculatin of dry-matter accumulation 10 spikes were sampled at 5-day intervals from anthesis to maturity. Spikes of the wheat were dried in oven at 70 ± 1°C for 48 hr.

RESULTS AND DISCUSSION

Growth

The number of days taken from emergence to 75% booting, 75% heading and physiological maturity were significantly reduced when sowing was delayed beyond 15 November during 1987–88 and 2 December during 1988–89 (Table 1). Longest period of ear growth was available to normal-sown crop. There was a reduction in the total life-span of the crop when sowing was delayed. 'UP 1183' took the maximum number of days from sowing to attain physiological maturity, whereas 'Sonalika' the minimum. The relative distribution of the duration of various growth stages and their optimum balance obviously greatly depend on the seasonal conditions under which the crop is grown. An adequately long vegetative stage is required to establish the root-system and leaf canopy as a basis for later crop growth. Rao *et al.* (1980) and Saini *et al.* (1986b) reported reduction in vegetative growth period with delay in sowing. Saini *et al.* (1986a) also reported significant shortening

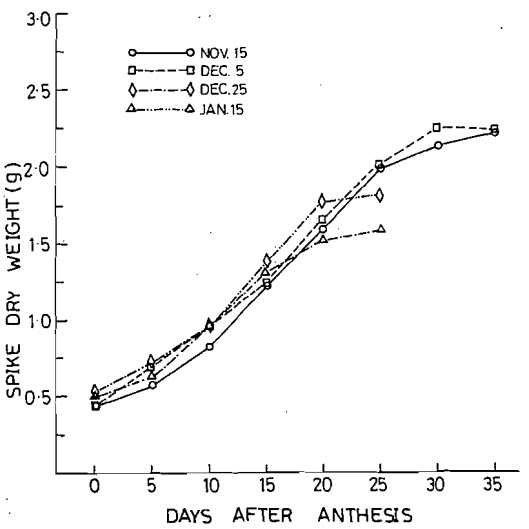

Fig. 1. Spike-dry weight of wheat genotypes under varying sowing dates during 1987–88.

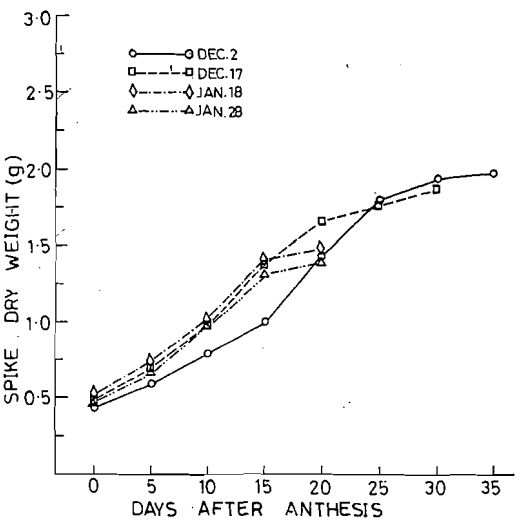

Fig. 2. Spike dry weight of wheat genotypes under varying sowing dates during 1988–89.

of the period of ear growth. When crop is sown late, its flowering period gets shortened considerably because by the time it attains flowering stage, the atmospheric temperature starts rising. Therefore the late-sown crop is forced to flower and mature early. The grain-growth duration has very strong negative association with temperature prevailing during this period.

Dry-matter accumulation in spikes

Late-sown crop had heavier spikes than timely sown crop at anthesis, but the final spike dry weight was lower in late-sown crop. The late-sown crop accumulated maximum dry weight by 20–25 days after anthesis, whereas in early-sown crops dry-matter accumulation continued at later stages also (Figs 1, 2). The late-sown crop was exposed to higher temperate during grain-filling period and therefore forced to attain the constant spike-dry weight earlier. The rate of dry-matter accumulation in ear was faster at high temperature, but as the overall growth is the product of growth rate and growth duration and growth duration is more affected by temperature (Weigand and Cuellar, 1981), high temperature results in lower final spike-dry weight.

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