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Effect of different genotypes under varying dates of sowing on growth and yield of wheat

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Abstract
The present investigation entitled "Effect of different genotypess under varying dates of sowing on growth and yield of wheat" was carried out during *rabi* season of 2011-2012 at the Research Farm of Indira Gandhi Krishi Vishwavidyalaya, Raipur in split plot design with three replication. Results of the trial indicated that among various important growth characters for different wheat varieties, plant height was greatly influenced in different dates of sowing. Maximum plant height was observed in variety Sujata and Amar under D_3 (16 December). Dry matter accumulation of plant was maximum in first date of sowing and there after the rate of biomass accumulation declined and minimum was recorded under D_5 (05 January) sowing. Maximum grain yield was observed in D_1 as compare to delayed sowings (D_2, D_3, and D4). Under the D_1 the grain yield was observed maximum in Sujata and minimum in Kanchan.

Keywords: Growth attribute, yield, CGR, wheat

Introduction
Three main species commonly grown in the world including India are the common wheat (*Triticum aestivum)* the marconi or durum wheat (*T. durum*) and the emmer wheat (*T. dicoccum*), out of these species maximum area is under *T. aestivum*. In India, more than 80 percent of the total wheat area is under this species whereas the area under marconi and emmer wheat is only 12 percent and 1 percent respectively. In Chhattisgarh wheat crop is grown in 1.63 lakh ha with an average productivity of 1108 kg/ha. The main reasons for low productivity are shorter winter span and high temperature during the grain filling and maturity stages. Seasonal temperature is important climatic factor which has profound effects on the yield of rabi crops. Changes in seasonal temperature affect the grain yield, mainly through phonological development processes. Winter crops are especially vulnerable to high temperature during reproductive stages and differential response of temperature change (rise) to various crops has been noticed under different production environments. The effect of temperature on the wheat productivity can easily by seen in Central India because of high inter-annual fluctuations in the productivity due to fluctuations in seasonal temperature. In the state wheat is grown mostly under irrigated conditions in rice based cropping system. The sowing of wheat is often delayed due to delay in harvesting of medium and late duration rice varieties. Late sown wheat crop faces high temperature during grain filling and ripening phases which is one of the major causes of stunted growth and low productivity of wheat in this area. Therefore, the present investigation was conducted to study the effect of different genotypes under varying dates of sowing on growth and yield of wheat.

Materials and Methods
To study the Effect of different genotypes under varying dates of sowing on growth and yield of wheat an experiment was conducted at the Research cum Instructional farm of Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). Five different dates of sowing in main plot and four varieties in sub plot were evaluated in split plot design. Nutrients were applied uniformly to the crop as per the recommendations. i.e. 100 kg N, 60 kg P_2O_5, and 40 kg K_2O/ ha. One third of N and full quantity of P_2O_5, and K_2O were applied before sowing as basal. The remaining half quantity of nitrogen was applied as two equal split doses, first at the crown root initiation stage and second at ear head initiation stage. Six irrigations (excluding rainfall) were given to the crop for proper growth and development from sowing to maturity. Come up irrigation was given just after sowing and the rest five irrigations were given at crown root initiation, tillering, late jointing, flowering and dough stages, respectively. The crop was harvested on different dates as per maturity of the respective varieties.

Result an Discussion

The plant height is the best measures and index of the total performance and response of the crop to the weather condition. The plant height of the different varieties at 15 days intervals from 30 DAS to maturity are sown in Table 1. It can be seen that the initial plant height up to 30 DAS was higher in Kanchan (29.3 cm) followed by GW-273 (28.9 cm) and sujata. It was observed that the plant height increased rapidly from 45 DAS to 60 DAS that is till the crop entered reproductive stage. There after the increase in height was marginal. At maturity Sujata attained maximum height of 122.8 cm in D_4-26 December followed by Amar (117.6 cm) when the crop was sown on D_2- 06 December. It was observed that the plant height increased with advancement in crop growth and reached to maximum at maturity. The increase in plant height took place slowly up to 45 days after sowing. Maximum rate of increase in plant height was observed between 45 to 60 days after sowing when the crop was in Ear emergence stage. In general, higher plant height was observed in varieties Sujata and Amar and lower plant height was recorded in varieties Kanchan and GW-273. It was observed that plant height decreased from the first date of sowing when the sowing was delayed of 26 November to 05 January. It was also observed that the average plant height varied among the varieties because of the genotypic characters of these varieties Shahzad *et al*., (2002) [2] found that the decrease in plant height in late sowing was due to shorter growing period. Early sown crop may have enjoyed the better environmental conditions especially the temperature and solar radiation which resulted to tallest plants. Noureldin *et al.* (2000) [1] also reported decrease on plant height under delayed sown conditions.

The accumulated dry matter at 15 days interval from sowing to maturity for all the four varieties in respect of different thermal environments are shown in Table 2. The data revealed that during different crop growth stage the dry matter production should fluctuating trend due to different dates of sowing. The dry matter production was variable at 45, 60 and 75 days after sowing as well as later dates. Further it was observed that the rate of increase in dry matter was slow up to 45 days after sowing and then increased sharply upto 90 DAS but continued up to maturity in all the varieties under all the sowing dates. The highest dry matter was observed at maturity with variety GW-273 (539.0 g/m^2) under 06 December sowing while lowest dry matter was observed in variety Sujata (255.8 g/m^2) under 05 January sowing. The dry matter growth rate varied differently for different varieties. The dry matter production decreased considerably in all the varieties, when sowing was delayed from 26 November to 06 December, 16 December, 26 December and 05 January. However, different varieties exhibited different trends of decrease in dry matter. At maturity lowest decrease in dry matter was observed in Sujata (255.8 g/m^2) to D_2 and it was Maximum in GW-273 (539.0 g/m^2) in D_5 as compared.

The crop growth rate of wheat varieties under different sowing dates are given in Table 3. It is clear from the data that the crop growth rate increased slowly during initial stage of the crop and increased at higher rate during 30 to 60 days after sowing. During 60 to 75 day after sowing the increase in crop growth rate showed fluctuating trend. After 75 days it again increased rapidly between 75-90 days after sowing except in GW-273 under 05 January sowing (D_5). In general the crop growth rate decreased in delayed sowing and higher values were recorded with D1 (26 November) sowing as compared to D_2, D_3, D_4 and D_5 sowing (06, 16, 26 December and 05 January) up to 75 days after sowing. However during maturity stage decrease in crop growth rate was recorded with variety Kanchan (29.47 g / m^2 / day) followed by Amar (26.92g / m^2 / day) and Sujata (20.06 g / m^2 / day) under D_2 (05 December). Higher crop growth rate was recorded in varieties GW-273 (28.98 g/m^2/day), Kanchan followed by (23.91g/m^2/day) under 4th sowing dates (D_4). Higher crop growth rate associated with timely sowing was mainly due to high Leaf area Index which accumulated dry matter at a faster rate per unit leaf area per unit time and there by reducing tiller mortality and senescence of leaf (Mc Donald, 1984). Timely seeded (26 November and 06 December) crop maintained higher crop growth rate throughout the crop growth period than late seeded crop (16, 26 December and 05 January). This finding is also supported by the earlier worker Swan *et al.* (1987) [3].

Grain yield (kg/ha) as influenced by different sowing dates are given in Table 4. Varieties and sowing dates showed significant effect on grain yield. On the mean basis the variety Kanchan produced higher grain yield (3214.7 kg/ha) followed by Amar (3130.0 kg/ha), Sujata (3002.2 kg/ha) and GW-273 (2898.3 kg/ha). On an average wheat varieties sown on 06 December produced maximum grain yield followed by sowing on 16 December. The varieties Sujata, Kanchan and GW-273 produced maximum grain yield (3837.5 kg/ha, 3670.0 kg/ha and 3643.3 kg/ha respectively) when sown on 06 December (D2), whereas the variety Amar, sown on 26 December (D4) produced maximum grain yield (3875.0 kg/ha). This result are in close confirmation with findings of Pandey *et al.* (2007) [4]

Table 1: Effect of different genotype under varing sowing dates on plant height (cm) of wheat varieties at 15 days intervals

Varieties	Sowing dates	Plant height (cm)					
		30	45	60	75	90	Maturity
Kanchan	D1-26 Nov.	29.31	56.64	74.00	83.65	84.12	81.3
	D2-06 Dec.	28.93	42.88	66.29	80.95	82.02	85.95
	D3-16 Dec.	31.70	43.64	64.18	69.18	67.55	70.02
	D4-26 Dec.	32.51	41.27	63.56	85.21	88.28	88.74
	D5-05 Jan.	32.51	48.48	69.41	77.94	83.62	78.58
GW-273	D1-26 Nov.	28.88	53.40	72.64	81.76	81.84	77.31
	D2-06 Dec.	27.70	43.68	63.11	82.10	76.85	86.48
	D3-16 Dec.	32.63	34.26	59.52	65.83	76.55	80.36
	D4-26 Dec.	39.83	44.12	57.88	77.62	84.23	87.01
	D5-05 Jan.	37.56	43.90	69.40	82.74	86.22	82.28
Sujata	D1-26 Nov.	28.87	46.48	76.31	102.68	109.50	115.87
	D2-06 Dec.	32.59	44.63	52.76	88.32	106.02	114.01
	D3-16 Dec.	35.58	36.23	60.50	100.02	110.71	111.56
	D4-26 Dec.	39.77	40.79	80.36	101.00	122.40	122.88

	D5-05 Jan.	23.52	41.20	79.03	116.39	116.99	115.43
Amar	D1-26 Nov.	23.94	54.80	73.72	96.53	104.92	114.58
	D2-06 Dec.	27.78	46.74	56.33	93.10	108.03	117.65
	D3-16 Dec.	31.74	31.97	54.60	85.28	94.66	108.97
	D4-26 Dec.	35.13	44.30	56.16	88.12	96.96	101.46
	D5-05 Jan.	24.70	39.72	71.45	109.93	107.50	111.01

Table 2: Effect of different genotype under varing sowing dates on dry matter production (g/m^2) of wheat varieties at 15 days interval.

Varieties	Sowing dates	Dry matter production (g/m^2)					
		30	45	60	75	90	Maturity
Kanchan	D1-26 Nov	100.94	454.72	637.98	1050.56	1644.93	2086.91
	D2-06 Dec	105.35	407.68	602.7	1316.14	1893.36	2475.97
	D3-16 Dec	102.9	362.11	589.47	1216.44	1828.68	2461.76
	D4-26 Dec	100.94	370.44	587.02	1154.44	1791.93	2275.07
	D5-05 Jan	95.06	329.77	546.35	1028.02	1783.11	2074.17
GW-273	D1-26 Nov	136.22	434.14	695.31	1093.68	1709.61	2231.46
	D2-06 Dec	87.71	330.75	633.08	1139.25	1933.54	2592.10
	D3-16 Dec	106.82	309.19	557.62	1157.87	1883.07	2281.93
	D4-26 Dec	117.6	360.15	794.78	1215.69	1881.6	2252.53
	D5-05 Jan	72.03	402.8	678.76	1351.42	1785.07	2053.10
Sujata	D1-26 Nov	112.21	444.43	607.6	1017.24	1839.46	2140.32
	D2-06 Dec	151.41	349.86	556.64	1150.03	1990	2469.6
	D3-16 Dec	99.96	284.69	558.11	1128.47	1878.17	2316.23
	D4-26 Dec	174.44	330.26	688.44	1279.88	1974.7	2242.72
	D5-05 Jan	60.76	387.1	719.81	1222.06	1999.2	2213.82
Amar	D1-26 Nov	139.16	371.42	652.19	953.65	1742.44	2146.2
	D2-06 Dec	103.88	199.92	564.97	1291.15	2033.55	2549.47
	D3-16 Dec	101.43	296.94	604.17	1262.73	2015.37	2314.76
	D4-26 Dec	117.6	343.98	647.78	1106.91	1800.01	2141.3
	D5-05 Jan	77.42	345.45	649.25	1109.85	1720.88	2043.3

Table 3: Effect of different genotype under varing sowing dates on Crop growth rate (CGR) (g/m^2/day) of wheat varieties at 15 days interval.

Varieties	Sowing dates	Crop growth rate (CGR) (g/m^2/day)					
		0- 30	30-45	45-60	60-75	75-90	90 -Maturity
Kanchan	D1-26 Nov	3.36	23.59	12.22	27.51	39.62	29.47
	D2-06 Dec	3.51	20.16	13.00	47.56	38.48	38.84
	D3-16 Dec	3.43	17.28	15.16	41.78	40.83	42.21
	D4-26 Dec	3.36	17.97	14.44	37.83	42.50	32.21
	D5-05 Jan	3.17	15.65	14.44	32.11	50.34	19.40
GW -273	D1-26 Nov	4.54	19.86	17.41	26.56	41.06	34.79
	D2-06 Dec	2.92	16.20	20.16	33.74	52.95	43.90
	D3-16 Dec	3.56	13.49	16.56	40.02	48.35	26.59
	D4-26 Dec	3.92	16.17	28.98	28.06	44.39	24.73
	D5-05 Jan	2.40	22.05	18.40	44.84	28.91	17.87
Sujata	D1-26 Nov	3.74	22.15	10.88	27.31	54.81	20.06
	D2-06 Dec	5.05	13.23	13.79	39.56	56.00	31.97
	D3-16 Dec	3.33	12.32	18.23	38.02	49.98	29.20
	D4-26 Dec	5.81	10.39	23.91	39.40	46.32	17.87
	D5-05 Jan	2.03	21.76	22.18	33.48	51.81	14.31
Amar	D1-26 Nov	4.64	15.48	18.72	20.10	52.59	26.92
	D2-06 Dec	3.46	6.40	24.34	48.41	49.49	34.39
	D3-16 Dec	3.38	13.03	20.48	43.90	50.18	19.96
	D4-26 Dec	3.92	15.09	20.25	30.61	46.21	22.75
	D5-05 Jan	2.58	17.87	20.25	30.71	40.74	21.49

Table 4: Grain yield (kg/ha) of wheat varieties under different thermal environments

Grain yield (kg/ha)						
Varieties	**D1-26 Nov**	**D2-06 Dec**	**D3-16 Dec**	**D4-26 Dec**	**D5-05 Jan**	**Mean**
Kanchan	2705.0	3670.0	3386.7	2983.3	3328.3	3214.7
GW-273	2800.0	3643.3	3415.0	2291.7	2341.7	2898.3
Sujata	2900.0	3837.5	3175.0	2808.3	2290.0	3002.2
Amar	2810.0	3333.3	2883.3	3875.0	2748.3	3130.0
Mean	2803.8	3621.0	3215.0	2989.6	2677.1	3061.3
	SEm ±	CD (P=0.05)	CV (%)			
D	85.5	244.7	9.5			
V	76.4	218.9				
DXV	170.9	489.4				

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