Indian Journal of Agronomy **44** (4) : 733–737 (December 1999)

Yield and nutrient uptake of wheat (*Triticum aestivum*) varieties under different sowing dates

S.R. PATEL[1], D.S. THAKUR AND NAGESHWAR LAL

Regional Agricultural Research Station, Indira Gandhi Krishi Vishwavidyalaya, Raigarh, Madhya Pradesh 496 001

Received: August 1998

ABSTRACT

A field experiment was conducted during the winter (*rabi*) season of 1994–95 and 1995–96 to study the effect of different sowing dates on yield attributes and yield and uptake of major nutrients by 4 varieties, viz. 'Lok 1', 'Swati', 'Mangla' and 'GW 173' of wheat (*Triticum aestivum* L. emend. Flori & Paol.) under rice-based cropping system in the eastern Madhya Pradesh. The study showed that sowing of wheat in the first week of December (5 December) was most suitable. Thereafter, yield decreased to 46.2–67.3 kg/day with delay in sowing from 5 December to 5 January. Early sowing in the last week of November (25 November) was also inferior to sowing in the first week of December in the study area. Among the varieties, 'GW 173' being at par with 'Lok 1' gave significantly higher grain yield than 'Swati' and 'Mangla'. The uptake of nitrogen, phosphorus and potassium decreased significantly with delay in sowing beyond optimum date.

Key words : Wheat varieties, Sowing dates, Nutrient uptake

Late-planted wheat crop faces high temperature during grain-filling and ripening phases, one of the major causes of poor wheat growth and productivity. Temperature cannot be manipulated easily under field conditions but seeding time can be so adjusted that the various physiological stages of crop can meet their specific (most suitable) temperature requirements during the growth cycle (Tewari and Singh, 1993; 1995). The adverse effects of delayed sowing can also be minimized by selecting a suitable cultivar, as the magnitude of yield reduction varies with the varieties. Therefore present study was undertaken to find out the optimum sowing time vis-a-vis a suitable variety for maximum wheat productivity.

MATERIALS AND METHODS

The field experiment was conducted during the winter (*rabi*) season of 1994–95 and 1995–96 in split-plot design with 3 replications at Raigarh. The treatments comprised 5 sowing dates (25 November, 5, 15, 25 December and 5 January) as main

Present address : [1]Department of Agrometeorology, I G K V, Raipur, Madhya Pradesh 492 012

plots and 4 varieties ('Lok 1' 'Swati', 'Mangla' and 'GW 173') as subplots. The soil experimental site were was sandy loam in texture, low in available nitrogen (239.6 kg/ha), medium in phosphorus (14.3 kg P_2O_5/ha) and high in potash (335.9 kg K_2O/ha, with pH 6.3. A uniform basal dose of 40 kg N, 60 kg P_2O_5 and 40 kg K_2O/ha were applied at the time of sowing. Nitrogen was top-dressed @ 40 kg/ha at crown-root initiation and late-tillering stages. Sowing was done at 18 cm row spacing using 120 kg seed. All the recommended cultural practices were followed to raise the crop. The nitrogen, phosphorus and potassium contents were estimated using standard procedures (Chapman and Pratt, 1961). The mean maximum and minimum temperatures recorded during crop season were 38.9°C and 10.0°C in 1994–95 and 41.0°C and 13°C in 1995–96 respectively.

RESULTS AND DISCUSSION

Yield attributes and yield

The length of ear, grains/ear, test weight and yield were significantly influenced by sowing time and varieties (Table 1). Sowing of wheat during the first week of December gave significantly higher yield compared to other sowing dates. This may be because sowing of wheat in the first week of December provides sufficient period for vegetative growth to the crop, resulting in better yield attributes (Tewari and Singh, 1995; and Behera, 1994). Sharp decrease in grain yield with delay in sowing was mainly due to significant reduction in grains/ear and test weight. Behera (1994) reported that higher temperature during later part of the crop growth in delayed sowing caused forced maturity of the crop and resulted in lower test weight, less filled grains/ear and ultimately the lower grain yield. Wiegand and Cuellar (1981) estimated 3.2 mg decrease in kernel weight for each 1°C increase in temperature between 23.7 and 27.8°C during grain-growth duration. Similarly, with 1°C increase in mean maximum temperature during ear growth, the rate of decline in grain yield was 134.12 ± 47.26 kg/ha beyond 27°C (Tewari and Singh, 1993). Our results confirm those of Singh *et al.* (1995).

Among the varieties (Table 1), 'GW 173' gave significantly higher grain yield than that of 'Swati' and 'Mangla', but it was found at par with 'Lok 1'. Ears/m row length were significantly higher in 'GW 173' but the test weight was significantly higher in 'Lok-1' than other varieties. The grain yield due to varieties differed significantly, which may be due to the significant differences in test weight, effective tillers/m row length and grains/ear (Behera, 1994).

Nutrient uptake

Nitrogen, phosphorus and potassium uptake in grain and straw varied significantly with the sowing time and the uptake decreased consistently with delay in sowing beyond 5 December (Table 2). The development of root system and leaf canopy were probably affected adversely under late-sown condition and consequently, the crop was not able to absorb or utilize nutrients optimaly as compared to timely sown crop. Tewari and Singh (1995) concluded that root system and leaf canopy thus act as basis for later crop growth. Rao *et al.* (1980) and Saini *et al.* (1986) reported reduction in vegetative

Table 1. Effect of dates of sowing on yield attributes of wheat varieties

Treatment	Ears/m row			E length (cm)			Grains/ear			Ear weight (g)			Test weight (g)		
	Y_1	Y_2	Mean	Y_1	Y_2	Mean	Y_1	Y_2	Mean	Y_1	Y_2	Mean	Y_1	Y_2	Mean
Sowing date															
25 Nov.	85.3	81.3	83.3	8.6	6.5	7.6	36.9	26.5	31.7	2.29	1.62	2.00	46.1	46.7	46.4
5 Dec.	91.1	89.7	90.4	9.2	7.6	8.4	41.2	31.5	36.4	2.55	1.91	2.23	47.6	44.2	45.9
15 Dec.	88.1	83.5	85.8	8.7	7.8	8.3	36.4	29.3	32.8	1.92	1.61	1.77	39.2	41.7	40.5
25 Dec.	84.1	78.5	81.3	8.1	7.8	7.9	32.3	27.6	30.0	1.56	1.30	1.43	37.1	39.2	38.2
5 Jan.	79.5	74.7	77.1	8.0	7.3	7.6	28.6	24.8	26.7	1.43	1.34	1.39	35.6	36.2	35.9
CD (P = 0.05)	19.9	14.0	16.0	0.6	NS	NS	3.82	NS	5.74	0.36	0.36	0.30	4.6	2.4	3.4
Variety															
'Lok 1'	85.2	82.4	83.8	8.3	7.1	7.7	30.6	25.0	27.8	1.96	1.57	1.77	49.8	44.5	47.7
'Swati'	81.8	78.3	80.1	8.2	7.2	7.7	38.3	31.0	34.7	1.99	1.55	1.77	37.2	40.8	39.0
'Mangla'	80.8	77.5	79.2	9.4	8.4	8.9	36.6	28.8	32.7	2.00	1.62	1.81	39.3	42.0	40.7
'GW 173'	93.8	87.6	90.7	8.0	7.0	7.5	34.9	27.0	30.9	1.84	1.48	1.66	38.2	39.1	38.7
CD (P = 0.05)	5.8	5.2	4.9	0.6	0.2	NS	2.86	2.97	2.80	NS	0.20	NS	5.5	2.1	3.7

Y_1, 1994-95; Y_2, 1995-96

Table 2. Effect of dates of sowing on grain yield and uptake of major nutrients of wheat varieties

Treatment	Grain yield (kg/ha)			N uptake (kg/ha)*			P uptake (kg/ha)*			K uptake (kg/ha)*		
	Y_1	Y_2	Mean	Grain	Straw	Total	Grain	Straw	Total	Grain	Straw	Total
Sowing date												
25 Nov.	3,024	2,581	2,803	52.69	25.53	78.62	11.09	6.94	18.03	19.72	34.52	54.24
5 Dec.	4,251	2,793	3,522	71.85	30.52	82.37	16.08	9.96	26.04	26.94	42.42	69.36
15 Dec.	3,341	2,664	3,003	55.85	25.87	80.72	12.49	7.81	20.30	19.94	33.41	53.35
25 Dec.	2,221	2,438	2,330	42.41	18.07	60.48	8.73	5.35	14.08	14.96	27.88	42.84
5 Jan.	1,993	1,651	1,822	32.98	14.20	47.18	6.07	3.83	9.90	11.66	22.25	33.91
CD (P = 0.05)	740	372	526	9.63	6.92	16.64	3.40	1.40	2.41	5.45	6.23	5.60
Variety												
'Lok 1'	3,053	2,529	2,791	51.91	21.10	73.01	11.00	5.94	16.94	18.60	31.76	50.36
'Swati'	2,871	2,277	2,574	46.85	20.79	67.64	10.16	6.36	16.52	17.68	30.92	48.60
'Mangla'	2,683	2,335	2,509	47.17	23.80	70.97	10.41	6.91	17.32	17.74	30.24	47.98
'GW 173'	3,258	2,561	2,918	54.71	25.67	80.38	12.05	7.92	19.97	20.55	35.46	56.01
CD (P = 0.05)	387	NS	315	7.22	3.84	8.75	3.23	1.36	2.25	2.85	4.25	3.32

Y_1, 1994-95; Y_2, 1995-96; Mean data of 2 years

growth period with delay in sowing. The nutrient content in grain and straw and uptake have negative association with delay in sowing and temperature prevailed during the crop-growth period. Nutrient uptake was recorded significantly higher with sowing of wheat up to first week of December compared to 15 and 25 December and 5 January owing to the higher grain yield.

Among the varieties, 'GW 173' and 'Lok 1' showed significantly higher uptake of major nutrients than 'Swati' and 'Mangla'. The N, P and K content in grain and straw did not differ significantly among different varieties.

REFERENCES

Behera, Aswini Kumar. 1994. Response of wheat (*Triticum aestivum*) varieties to sowing date. *Indian Journal of Agronomy* **39** (1) : 171–173.

Chapman, H.D. and Pratt, P.F. 1961. *Methods of Analysis for Soils, Plants and Water*. University of California, California.

Rao, M.H., Sinha, M.N. and Rai, R.K. 180. Effect of dates of sowing and phosphorus levels on wheat yield and phosphorus utilization. *Indian Journal of Agricultural Sciences* **50** : 503–511.

Saini, A.D., Dhaliwal, V.K., Phadnawis, B.N. and Nanda, R. 1986. Thermal and photoperiod effect on phase duration of four wheat varieties grown in different sowing dates. *Indian Journal of Agricultural Sciences* **56** : 646–656.

Singh, Vireshwar, Singh, R.P. and Panwar, K.S. 1995. Response of wheat (*Triticum aestivum*) to seed rate and date of sowing. *Indian Journal of Agronomy* **40**(4) : 697–656.

Tewari, S.K. and Singh, Mahendra. 1993. Yielding ability of wheat (*Triticum aestivum*) at different date of sowing - a temperature dependent performance. *Indian Journal of Agronomy* **38**(2) : 204–209.

Tewari, S.K. and Singh, Mahendra. 1995. Influence of sowing date on phase duration and accumulation of dry matter in spikes of wheat (*Triticum aestivum*). *Indian Journal of Agronomy* **40** (1) : 43–46.

Wiegand, C.L. and Cuellar, J.A. 1981. Duration of grain filling and kernel weight of wheat as affected by temperature. *Crop Science* **21** : 95–101.