Indian Journal of Agronomy **57** (1): 92–95 (March 2012)

Effect of management practices on growth, yield and quality of late sown wheat (*Triticum aestivum*)

A. RAM[1], R.K. PANNU[2] AND DASHARATH PRASAD[3]

CHOUDHARY CHARAN SINGH HARYANA AGRICULTURAL UNIVERSITY, HISAR, HARYANA 125 004

Received : October 2011; Revised accepted : January 2012

ABSTRACT

A field experiment was conducted at Hisar during *rabi* season of 2007-08 to study the effect of different agronomic management practices on growth, yield and quality of late sown wheat(*Triticum aestivum* L. emend. Fiori & Paol.). Dry seeding with overnight soaked seed on 15 December with 25% higher seed rate followed by irrigation produced higher grain and biological yield followed by dry seeding with 25% higher seed rate on 15 December followed by irrigation. Crop germination was earlier by 2 days when sowing with soaked seeds was adopted.

Key words: Dry seeding, Time of sowing, Seed soaking, Wheat

Wheat is the most important winter season food crop of India and improvement in its productivity has played a key role in making the country self-sufficient in food grain. Crop occupies an area of about 28.5 million hectare with total production of 80.70 million tonnes and a productivity of 2.83 tonnes/ha and shares 12.43% of total production of world (MOF, 2010). However, in the past decade a general slow down in increase in the productivity of wheat has been noticed, particularly under environments relatively unfavorable for growth and development of wheat (Nagarajan, 2005). Current estimates indicates that in India alone around 13.5 million hectare of wheat is heat stressed (Joshi *et al*., 2007). During past few years, more than 50% sowing of wheat often gets delayed till December or early January causing substantial loss in grain yield. Late sown suffers due to sub-optimal temperature at sowing, which causes delayed germination, slow growth, lesser development and ultimately low yield. The delayed sowing further causes supra-optimal thermal stress at reproductive phase which results in forced maturity. This high temperature stress at reproductive phase, of wheat results in poor yield due to reduced number of grains per spike and shriveled grains of low quality (Sharma *et al*., 2007). The problem of high temperature stress will further aggravate with the global warming in the time to come. Hence, the present study was undertaken to minimize the yield losses under late sown condition.

A field experiment was conducted at agronomy research farm of Chaudhary Charan Singh, Haryana Agricultural University, Hisar (at 29°10' N latitude and 75°46' E longitude at an altitude of 215.2 m above mean sea level), during *rabi* season of 2007-08 to study the effect of different agronomic management practices on growth, yield and quality of late sown wheat. The soil of the experimental site was sandy loam, having 0.4% organic carbon, 171.6 kg/ha available N, 10.5 kg/ha available P, 256.8 kg/ha available K and 7.7 pH. The experiment was laid out in random block design with three replications. There were ten treatment *viz.* dry seeding on 15 December followed by irrigation, dry seeding with overnight soaked seed on 15 December followed by irrigation, dry seeding with 25% higher seed rate on 15 December followed by irrigation, dry seeding with overnight soaked seed with 25% higher seed rate on 15 December followed by irrigation, dry seeding on 1 January followed by irrigation, dry seeding with overnight soaked seed on 1 January followed by irrigation, dry seeding with 25% higher seed rate on 1 January followed by irrigation, dry seeding with overnight soaked seed with 25% higher seed rate on 1 January followed by irrigation, dry seed sowing on 1 January after pre-sowing irrigation on 15 December and soaked seed sowing on 1 January after pre-sowing irrigation on 15 December. Sowing was done in rows spaced 20 cm apart at a depth of 5 cm. The recommended dose of nitrogen (150 kg N/ha), phosphorus (60 kg P_2O_5/ha) and zinc sulphate (25 kg/ha) were applied. Irrigation was given at

***Short note**

Based on a part of M.Sc. thesis of the first author submitted to CCS, Haryana Agricultural University, Hisar during 2009. (unpublished)

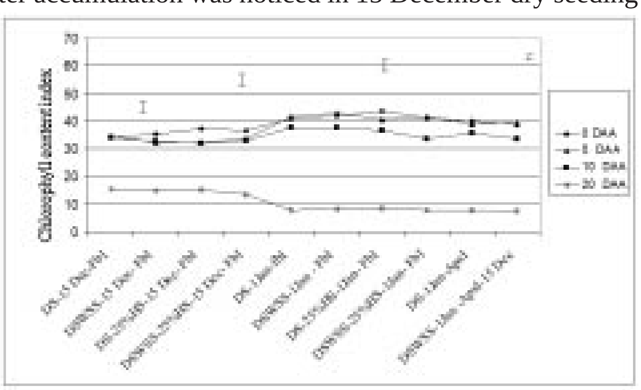
[1]**Corresponding author Email:** ashusirvi84@gmail.com

[1&3] Research Scholar, IARI, New Delhi; [2] Professor Agronomy, Department of Agronomy

crown root initiation, late tillering, late jointing, booting, dough and milk stages of the crop. One weeding cum hoeing was done 40 DAS with long tine hand hoe. All the necessary observations were recorded as per the established norms.

Crop attained more height in dry seeding with overnight soaked seed on 15 December followed by irrigation over other treatments at physiological maturity. The highest plant height in dry seeding with overnight soaked seed on 15 December followed by irrigation was because of early sowing (15 days) and overnight seed soaking with water (Table 1). At 50 and 90 DAS the LAI was recorded significantly higher in dry seeding with overnight soaked seed with 25% higher seed rate on 15 December followed by irrigation than all other treatments except dry seeding with 25% higher seed rate on 15 December followed by irrigation which was the statistically at par. The lowest LAI was recorded in dry seeding on 1 January followed by irrigation. The higher LAI recorded in dry seeding with overnight soaked seed with 25% higher seed rate on 15 December followed by irrigation due to 47% higher plant stand and 6 days longer vegetative phase than observed in dry seeding on 1 January followed by irrigation. Similar reductions in LAI and LAD with delayed sowing have been reported by Singh *et al.* (1995).

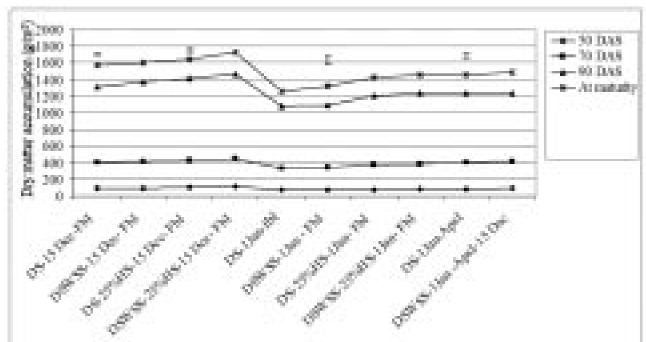
The chlorophyll content in 1 January sown treatments at anthesis was significantly higher than recorded in 15 December sown crop (Fig. 1). The higher chlorophyll content in 1 January sown crop was because of younger juvenile age of plants in late sown crop. Further, a sharp fall in chlorophyll content at 20 days after anthesis in 1 January sown treatments was observed which may be due to prevalence of high day temperature (29.6-36.4°C) after anthesis as compared to treatments, where wheat was sown on 15 December (29.6-33.9°C). This high temperature hastened the leaf senescence and crop maturity with squeezed reproductive phase in late sown crop. The highest dry matter accumulation was noticed in 15 December dry seeding



* DAA: Days after anthesis

Fig. 1. Effect of seeding treatments on chlorophyll content index of wheat under late sown conditions

with overnight soaked seed with 25% higher seed rate followed by irrigation at all the growth stages till maturity, whereas the minimum dry matter accumulation was recorded in dry seeding on 1 January followed by irrigation (Fig. 2). At maturity the plants in dry seeding with overnight soaked seed with 25% higher seed rate on 15 December followed by irrigation accumulated 36.8 per cent higher dry matter than the dry seeding on 1 January followed by irrigation. It was mainly due to use of 25% higher seed rate and 15 days early sowing with overnight soaked seed in dry seeding followed by irrigation. The finding of Rehman *et al.* (2008) also supports these results.



*DAS: Days after anthesis

Fig. 2. Effect of seeding treatments on dry matter accumulation (g/m^2) at different growth stages of wheat under late sown conditions

Among the yield attributing characters, number of spikes/m^2 and spike length (cm) were found significantly higher in treatments sown on 15 December (Table 1) over treatments sown on 1 January. The highest number of spikes/m^2 (420) were recorded in dry seeding with overnight soaked seed with 25% higher seed rate on15 December followed by irrigation and lowest number in dry seeding on 1 January followed by irrigation. An increase of 18.0% in number of spikes/m^2 was observed in dry seeding with overnight soaked seed with 25% higher seed rate on 15 December followed by irrigation over dry seeding on 1 January followed by irrigation. The highest number of grains/spike (49.6) were observed in dry seeding with overnight soaked seed on 15 December followed by irrigation. But, the difference among the treatments was non-significant. Highest test weight (41.7g) was found when the crop was sown in 15 December with soaked seed using normal seed rate. Spike length, spikes/m^2, also decreased with delay in sowing as shown in table 1. The spike length (8.76cm) was significantly higher in dry seeding with overnight soaked seed on 15 December followed by irrigation followed by dry seeding on 15 December followed by irrigation (8.56cm) and it was minimum

Table 1. Effect of seeding treatments on yield attributes, yields and quality of late sown wheat

Treatment	Plant height at maturity (cm)	LAI		Yield attributes					Yield (t/ha)		Harvest Index (%)	Protein Content (%)	Gross returns ($\times 10^3$ ₹/ha)	Net returns ($\times 10^3$ ₹/ha)	B:C ratio
		50 DAS	90 DAS	Spike/ m^2	Grains/ spike	Spike length (cm)	Spikelet/ spike	1,000-grain wt (g)	Grain	Biological					
DS-15 Dec-FbI	92.9	1.46	3.86	385	48.6	8.56	17.5	41.3	3.75	9.19	40.8	11.43	44.4	31.6	2.45
DSWSS-15 Dec- FbI	96.1	1.48	4.07	397	49.6	8.76	18.2	41.7	3.82	9.39	40.7	11.40	45.4	32.5	2.52
DS-25%HS-15 Dec- FbI	95.4	1.65	4.16	415	48.0	8.33	17.6	39.9	4.10	10.15	40.4	11.13	48.9	35.5	2.65
DSWSS-25%HS-15 Dec- FbI	95.9	1.86	4.32	420	48.3	8.33	17.6	39.9	4.20	10.36	40.5	11.20	50.0	36.6	2.74
DS-1Jan-fbI	89.9	1.09	3.22	356	45.6	7.33	16.8	39.5	2.89	7.43	38.8	11.50	35.3	22.4	1.74
DSWSS-1Jan - FbI	93.6	1.12	3.24	356	46.6	7.36	17.2	39.7	2.94	7.47	39.3	12.16	35.6	22.8	1.77
DS-25%HS-1Jan- FbI	92.3	1.18	3.61	367	47.0	7.60	17.1	38.5	3.37	8.43	40.0	11.86	40.5	27.0	2.02
DSWSS-25%HS-1Jan- FbI	92.6	1.29	3.70	367	47.6	7.96	17.4	38.3	3.40	8.70	39.0	11.63	41.4	28.0	2.09
DS-1Jan-ApsI	93.4	1.33	3.67	379	47.6	7.96	17.4	40.5	3.49	8.83	39.6	11.73	42.2	29.1	2.22
DSWSS-1Jan -ApsI-15 Dec	94.8	1.44	3.69	379	47.6	7.90	17.5	40.5	3.54	8.87	39.9	11.63	42.5	29.5	2.25
SEm±	0.81	0.06	0.08	8.68	1.56	0.17	0.63	0.51	0.03	0.07	0.29	0.41	0.33	0.33	0.03
CD (P=0.05)	2.42	0.17	0.23	25.8	N.S.	0.51	N.S.	1.52	0.09	0.20	0.86	N.S.	0.99	0.98	0.08

LAI: Leaf area index; DS: Dry seeding; FbI: followed by irrigation; DSWSS: Dry seeding with overnight soaked seed; DS-25%HS: Dry seeding with 25% higher seed rate; DSWSS-25% HS: Dry seeding with overnight soaked seed with 25% higher seed rate; ApsI-15 Dec: Soaked seed sowing after pre-sowing irrigation on 15 December

(7.33cm) in dry seeding on 1 January followed by irrigation. The highest number of spikelets (18.2) was recorded in dry seeding with overnight soaked seed on 15 December followed by irrigation and minimum in dry seeding on 1 January followed by irrigation (16.8). Among the yield attributes, highest association was found in effective tiller/ mrl with the grain yield (r = 0.97). The number of grains per spike also had positive correlation (r = 0.80) with grain yield. The number of effective tillers per running meter row length is the best yield attribute to predict grain yield with the following regression equation Y= 87.34 X - 3939.19 (R^2 =0.94).

The grain and biological yield was significantly higher in 15 December sown crop than the 1 January sown. But, among all the treatments dry seeding with overnight soaked seed with 25% higher seed rate on 15 December followed by irrigation recorded significantly higher grain yield (4.20 t/ha) and biological yield (10.36 t/ha). The increased yield in dry seeding with overnight soaked seed with 25% higher seed rate on 15 December followed by irrigation may be attributed to better germination, early emergence, taller plants (6cm at maturity), higher LAI, more number of effective tillers than dry seeding on 1 January followed by irrigation. The mean LAI (r = 0.99) showed highly significant and positive correlation with grain yield. This suggests greater significance of leaf area and dry matter accumulation during vegetative and active reproductive phase of crop. The significantly positive correlation among mean LAI, LAD, CGR, yield attributes and grain yield have also been reported by Tyagi (1997).

One of the main reason for higher grain and straw yield in 15 December sown treatments was extended vegetative and reproductive phase as compared to 1 January sown crop. The late planted crop was adversely affected during the reproductive phase because of supra-optimal thermal stress which leads to forced maturity as crop duration was shortened from 124 days to 114 days and reduced harvest index also. Delay in wheat sowing by 20 and 40 days from the normal sowing date (15 November) reduced grain yield by 23 kg/ha/day and 30 kg/ha/day, respectively (Kaur and Pannu, 2008). In North-West zone of India very little information is available on management practices such as dry seeding, seed soaking of wheat in late sown conditions. There was no significant difference in protein content among the treatments, which means that various seeding treatments had no significant effect on protein content. However, among all the treatments highest protein content was recorded in dry seeding with overnight soaked seed on 1 January followed by irrigation (12.16%) followed by dry seeding with 25% higher seed rate on 1 January followed by irrigation (11.86%) and the lowest protein content was observed in dry seeding with 25%

higher seed rate on 15 December followed by irrigation (11.13%). This slightly higher protein content in low yielding late sown treatments may be because of dilution effect. Among all the treatments, dry seeding with overnight soaked seed with 25% higher seed rate on 15 December followed by irrigation recorded significantly higher gross returns (49,981), net returns (36,598) and B:C ratio (2.74), while it was minimum in dry seeding on 1 January using normal seed rate followed by irrigation.

Based on one year study, dry seeding on 15 December with overnight soaked seed and 25% higher seed rate followed by irrigation was found more productive.

REFERENCES

Joshi, A.K., Mishra, B., Chatrath, R., Ortiz Ferrara, G. and Singh, R.P. 2007. Wheat improvement in India: Present status, emerging challenges and future prospects. *Euphytica* **157**(3): 457–64.

Kaur, A. and Pannu, R.K. 2008. Effect of sowing time and nitrogen schedules on phenology, yield and thermal use efficiency of wheat (*Triticum aestivum*). *Indian Journal of Agricultural Sciences* **78**(4): 3.

MOF, 2010. Economic Survey 2010–11. (*In*): Statistical Tables, Selected Indicators 1950–51 to 2010–11. Ministry of Finance, Government of India.

Nagarajan, S. 2005. Can India produce enough wheat even by 2020. *Current Science* **89**:1467–71.

Rehman, H., Farooq, M. and Afzal, I. 2008. How to improve output of late sown wheat crop. http://DAWN.com

Sharma, K.D., Pannu, R.K. and Behl, R.K. 2007. Effect of early and terminal heat stress on biomass partitioning, chlorophyll stability and yield of different wheat genotypes. (*In*): *Proceedings of the International Conference on Sustainable Crop Production in Stress Environment: Management and Genetic Options*. (Eds) D.P. Singh, V.S. Tomar, R.K. Behl, S.D. Upadhyaya, M.S. Bhale and D. Khare. Agrobios, Jodhpur. pp. 187–94.

Singh, V., Singh, R.P. and Pawar, K.S. 1995. Response of wheat (*Triticum aestivum*) to seed rate and date of sowing. *Indian Journal of Agronomy* **40**(4): 697–99.

Tyagi, P.K. 1997. Agronomic and physiological responses of wheat genotypes to desiccant spray under irrigated field conditions. *Ph.D. Dissertation*, submitted to CCS Haryana Agricultural University, Hisar (India).