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Response of different wheat varieties to different sowing dates

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Abstract
An experiment on effect of sowing dates to different wheat varieties was conducted. The sowing dates of S_2 (1st week of December) was found superior for growth, yield attributes and yield of wheat. The wheat variety Tapowan was found better to sowing date of 1st week of December with regards to growth and yield attributes (43.28 q ha^{-1}). Economically Tapowan wheat variety in S_2 (1st week of December) sowing date attained higher gross (72318 ` $ha^{-1}$), net monetary returns (36517 ` ha^{-1}) and B:C ratio 2.02.

Keywords: Wheat sowing date and wheat varieties

Introduction
Wheat is important staple food of the world's population. India stands second in wheat production next to the China. Area under wheat crop in India is reported 28.5 m ha with production 80.7 MT during 2009-10 (Anonymous, 2010) [1]. It contributes about 25 per cent of the total food grain production of the country. Wheat crop has remarkable adaptability. It provide about 20 per cent of total food calories for human being. It considered important food crop due to its bread making quality. It contains the characteristics substance 'gluten' which providing structural framework for the spongy cellular structure of bread and chapatti.
The green revolution is mainly due to introduction of high yielding varieties. There is no more land under cultivation and hence it is necessary to employ low cost technologies for improving wheat yield through natural resource management. Climate change is one of the important factor responsible for low yield in wheat. The low productivity of wheat in Maharashtra is due to shorter favourable growing period, high temperature with low humidity and short cool spell during its growing season with more fluctuation in temperature.
Keeping in this mind, it was thought to monitor the microclimatic element *viz.*, atmospheric temperature, humidity and light interception. Wheat crop sown at different dates because sowing at different dates ameliorate the microclimate to the reasonable extend. The late sowing (7th December) produced significantly higher grain yield (40.82 g ha^{-1}) as compared to early sowing (15th November) which produces low grain yield (32.50 g ha^{-1}) (Swarkar *et al.*, 2004) [8]. Yield with different dates of sowing can be related to the effect of photothermal quotient (PTQ).
Change in the optimum temperature during its vegetative or reproductive growth adversely affect the initiation and duration in different phenophases and finally yield of crop. Among different agronomic practices proper time of sowing is a most important factor and it is a non-cash input, about which the information is to be find out for obtaining maximum yield.

Material and Methods
An experiment on effect of different sowing dates on wheat varieties was conducted at Post Graduate Institute Research Farm, Mahatma Phule Krishi Vidyapeeth, Rahuri during the year of 2009-10 in *rabi* season. The soil of experimental field was clayey in texture, low in available nitrogen (169.02 kg ha^{-1}), medium in available phosphorus (16.30 kg ha^{-1}) and high in available potassium content (429.70 kg ha^{-1}). The pH of soil was moderately alkaline reaction (8.40).
The experiment was laid out in split plot design with three main treatment wheat varieties and four sowing date replicated three. The main plot treatments were of three varieties *viz.*, V_1 : Trimbak (NIAW 301), V_2 : Tapowan (NIAW 917), V_3 : Godavari (NIDW 295) and sub plot treatments four sowing dates *viz.*, S_1 : 3rd week of November (46 MW), S_2 : 1st week of December (48 MW), S_3 : 3rd week of December (51 MW), S_4 : 1st week of January (01 MW). Wheat crop was sown as per sowing treatment 3rd week of November, 1st week of December, 3rd week of December, 1st week of January 2009. The gross plot size was 4.5 m x 3.6 m and net plot size 3.5 m x 2.7 m.

Results and Discussion

The periodical plant height of wheat was significantly influenced by the wheat varieties. Variety Tapowan recorded the significantly higher plant height, functional leaves, tillers, leaf area and dry matter at all growth stages of the crop followed by variety Trimbak and Godavari. The increased height in wheat plant is genetically governed phenomenon, hormonal balance, nutrient absorption capacity and conversion of radiant energy to chemical energy in presence of chlorophyll. All these processes were reflected in height and other yield contributing characteristics (Table 1). The results are in the conformity with those of Nainwal and Singh (2000) [5], Sardana *et al.* (2002) [6], Mishra *et al.* (2003) [4], Jat *et al.* (2003) [3], Sardana *et al.* (2005) [7] and Gill (2009) [2]. The yield contributing characters *viz.*, length of panicle, number of spikelets per panicle, number of grains per panicle, weight of grains per panicle and thousand grain weight significantly higher of Tapowan variety than Trimbak and Godawari variety. All the growth attributing were increased with the advancement in age of the wheat crop. Plant count (33.36), plant height (81.49 cm), number of functional leaves per plant (1.83), total number of tillers per meter length (101.97), leaf area (0.75 dm^2) and dry matter per plant (12.15 g) were found significantly higher in variety Tapowan over Trimbak and Godawari variety recorded the lowest values.

Yield contributing characters *viz.*, length of panicle (8.75 cm), number of spikeletes per panicle (16.37), number of grains per panicle (42.85), weight of grain per panicle (1.84 g) and thousand grain weight (40.80 g) were found significantly higher in variety Tapowan.

Biological yield (109.23 g ha^{-1}), grain yield (43.28 g ha^{-1}) and straw yield (66.00 g ha^{-1}) was maximum in variety Tapowan and it was superior over Trimbak and Godawari. Harvest index was maximum in Godawari (40.45%) followed by Trimbak (40.40%) and Tapowan (39.65%).

Protein content found non-significant and protein yield significantly maximum by Tapowan (4.92 g ha^{-1}). The Tapowan variety recorded significantly maximum uptake of total nitrogen (102.55 kg ha^{-1}) and potassium (82.30 kg ha^{-1}) by wheat than rest of the wheat varieties. The phosphorus uptake found to be non-significant. The gross monetary returns (Rs. 72,318 ha^{-1}), cost of cultivation (Rs. 35,801.00 ha^{-1}), net monetary returns (Rs. 36,518.00 ha^{-1}) and B:C ratio (2.02) found significantly maximum in Tapowan variety.

Among all the sowing dates S_2 (1st week of December) sowing date recorded higher growth attributes *viz.*, plant height (81.34 cm), number of functional leaves per plant (2.02), total number of tillers per meter length (103.69), leaf area (0.72 dm^2) and dry matter per plant (11.87). The lowest values for all these characters were recorded by S_4 (1st week of January) sowing date.

Yield attributing characters *viz.*, length of panicle (8.27 cm), number of spikletes per panicle (16.28), number of grains per panicle (41.39), weight of grains per panicle (1.83 g) and thousand grain weight (41.21 g) were found significantly higher in S_2 (1st week of December). Biological yield (108.29 g ha^{-1}), grain yield (43.33 g ha^{-1}) and straw yield (64.99 g ha^{-1}) was maximum in variety Tapowan and it was significantly maximum in S_2 (1st week of December) over rest of the sowing dates. Harvest index significantly maximum at S_4 (1st week of January) (40.60%) protein content found non-significant and protein yield significantly maximum at S_2 (1st week of December) sowing date. The gross monetary returns (Rs. 73,194.00 ha^{-1}), net monetary returns (Rs. 38,194 ha^{-1}) and B:C ratio (2.09) found maximum at S_2 (1st week of December). Maximum cost of cultivation (Rs. 35,301 ha^{-1}) and S_1 (3rd week of November) sowing date.

Thus, it can be concluded that the Tapowan variety was found superior with regards to growth yield attributes and yield of wheat. The sowing date S_2 (1st week of December) was found significantly superior in all growth yield attributes of wheat yield.

Table 1: Effect of varieties and sowing dates on growth and yield contributing characters

Treatment	Plant height (cm)	Functional leaves plant^{-1}	No. of tillers plant^{-1}	Leaf area plant^{-1}	Dry matter plant^{-1}	Length of panicle (cm)	No. of spikletes panicle^{-1}	No. of grains panicle^{-1}	Wt. of grain panicle^{-1} (g)	1000 grain wt. (g)
Varieties										
V_1 : Trimbak	81.30	1.33	101.25	0.74	10.73	7.59	16.13	39.72	1.69	39.40
V_2 : Tapowan	81.40	1.83	101.97	0.75	12.15	8.75	16.37	42.85	1.84	40.80
V_3 : Godawari	79.95	1.30	99.15	0.64	9.71	6.69	14.27	37.58	1.69	39.15
SEm±	0.12	0.05	0.29	0.03	0.31	0.05	0.18	0.57	0.03	0.31
CD at 5%	0.35	0.18	0.92	0.08	1.21	0.15	0.53	1.75	0.10	1.03
Sowing dates										
S_1 : 46 MW	80.90	1.78	100.37	0.70	10.21	7.14	15.20	40.71	1.78	39.47
S_2 : 48 MW	81.34	2.02	103.69	0.72	11.87	8.27	16.28	41.39	1.83	41.21
S_3 : 51 MW	80.49	1.53	101.56	0.71	11.16	7.73	15.46	39.39	1.70	39.32
S_4 : 01 MW	80.92	0.62	97.56	0.69	10.21	7.57	15.42	38.71	1.64	39.13
SEm±	0.18	0.07	0.43	0.002	0.20	0.05	0.13	0.36	0.03	0.45
CD at 5%	0.53	0.24	1.29	0.006	0.60	0.17	0.39	1.07	0.09	1.37
Interaction										
SEm±	0.31	0.13	0.75	0.03	0.34	0.10	0.23	0.63	0.05	0.78
CD at 5%	N.S.	N.S.	2.23	N.S.	N.S.	0.30	0.68	N.S.	N.S.	N.S.
General mean	80.91	1.49	100.79	0.71	10.86	7.68	15.59	40.05	1.74	39.78

Table 2: Effect of varieties and sowing dates on yield, quality and economics

Treatment	Seed yield (g ha^{-1})	Straw yield (g ha^{-1})	Biological yield (g ha^{-1})	Harvest index (%)	Protein content (%)	Protein yield (g ha^{-1})	Gross monetary returns (Rs ha^{-1})	Cost of cultivation (Rs ha^{-1})	Net monetary returns (Rs ha^{-1})	B:C ratio
Varieties										
V_1 : Trimbak	40.27	59.48	99.72	40.40	11.58	4.64	68273	35402	32871	1.92

V_2 : Tapowan	43.28	66.00	109.23	39.65	11.65	4.92	72318	35801	36517	2.02
V_3 : Godawari	38.79	57.17	95.96	40.45	11.35	4.40	65741	35136	30605	1.87
SEm±	0.34	0.49	1.10	0.01	0.10	0.20	542.43	-	562.43	0.01
CD at 5%	1.02	1.44	3.32	0.03	N.S.	0.60	1611.01	-	1574.80	0.03
Sowing dates										
S_1 : 46 MW	41.71	62.84	104.60	40.04	11.00	4.74	70583	35301	35282	1.99
S_2 : 48 MW	43.33	64.99	108.29	39.98	11.42	4.94	73194	35000	38194	2.09
S_3 : 51 MW	39.92	59.97	99.89	40.04	11.49	4.62	67412	34136	33276	1.97
S_4 : 01 MW	38.03	55.73	93.76	40.60	11.46	4.32	63921	34136	29785	1.87
SEm±	0.46	0.69	1.15	0.01	0.13	0.15	830.99	-	745.90	0.02
CD at 5%	1.38	2.06	3.42	0.03	N.S.	0.42	2469.11	-	2230.70	0.06
Interaction										
SEm±	0.80	1.20	1.99	0.02	0.23	0.13	1439.33	-	1139.33	0.38
CD at 5%	N.S.	3.58	N.S.	N.S.	N.S.	0.30	N.S.	-	N.S.	N.S.
General mean	40.76	60.88	101.64	40.17	11.51	4.66	68778	34643	34135	1.98

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