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Performance of Wheat (*Triticum aestivum* L.) Varieties under Extended Sowing Dates

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Abstract The present investigation on "Performance of wheat (*Triticum aestivum* L.) varieties under extended sowing dates" was conducted during *rabi* of 2012-2013. The experiment was laid out in split-plot design with three replications and fifteen treatment combinations. The main plot treatments consisted of five sowing dates viz., S_1 : 45 MW (07th November 2012); S_2 : 47 MW (21st November 2012); S_3 : 49 MW (05th December 2012); S_4 : 51 MW (19th December 2012) S_5 : 01 MW (02nd January 2013) and three varieties viz., V_1 : NIAW-301 *(Trimbak)* ; V_2 : NIAW-917 *(Tapowan)* ; V_3 : NIAW-34 *(Niphad-34).* The gross plot size was 3.00 m × 2.25 m and net plot size was 2.40 m × 1.80 m.

Keywords Wheat, Sowing dates, Yield, Varieties.

Introduction

Wheat (*Triticum aestivum* L.) is the world's most important widely cultivated food crop. It originated in South West Asia. Wheat is the most important staple food crop of India. It is consumed as food by millions of people especially in developing countries. Therefore , it is called as "king of cereals". The total area under wheat in world during 2012-13 was 221.12 million hectares with an annual production of 697.8 million tonnes and average productivity of 3.16 tonnes ha^{-1} [1]. In India, an area under wheat was 29.64 million hectares with production of 92.46 million tonnes and average productivity of 3.12 tonnes ha^{-1} during 2012-13. In Maharashtra, wheat was grown on area of 0.59 million hectares and production of 0.88 million tonnes during 2012-13. The average productivity of wheat in Maharashtra was 1492 kg ha^{-1}.

The sowing time plays an important role among various agronomic manipulations, in influencing the quality and yield of wheat. Its time of sowing is one of the most important factors that govern the crop phenological development and efficient conversion of biomass into economic yield. Normal sowing has longer growth during which consequently provide an opportunity to accumulate more biomass as compared to late sowing hence manifested in higher grain and biological yields [2]. However, the higher protein yield, grain protein content, dry gluten content, beta carotene content and sedimentation index in late sown wheat have been reported [3]. The sowing time may play a crucial role in the yield improvement of this crop. The present study was therefore undertaken to evaluate the performance and adaptability of newly released varieties of *aestivum* wheat under extended sowing dates. With these considerations in view, the present investigation entitled performance of wheat (*Triticum aestivum* L.) varieties under extended sow-

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ing dates was planned at Agronomy Farm, College of Agriculture, Pune-5 during *rabi* of 2012-13 with the following specific objectives.

Materials and Methods

The field experiment was laid out in plot no. 14-C of 'B' division; survey no. 53-A duing *rabi* of 2012-13 at Agronomy Farm, College of Agriculture, Pune, Dist Pune (Maharashtra). The soil of experimental field was clay loam in texture, normal in reaction (pH 7.6) with low available nitrogen (164.23 kg ha^{-1}), medium available phosphorus (18.43 kg ha^{-1}) and high available potassium (410.50 kg ha^{-1}) while low in organic carbon content (0.36%).

Experimental details

The experiment was conducted in split plot design with fifteen treatment combinations and three replications. The treatment comprising five sowing dates viz., S_1 : 45 MW (2nd week of November), S_2 : 47 MW (4th week of November), S_3 : 49 MW (2nd week of December), S_4 : 51 MW (4th week of December), S_5 : 01 MW (1st week of January) and three wheat varieties viz., V_1 : NIAW-301 *(Trimbak)*, V^2 : NIAW-917 *(Tapowan)*, V_3 : NIAW-34 *(Niphad-34)* (Table 1). The gross plot size was 3.00 m × 2.25 m and net plot size was 2.40 m × 1.80 m.

The wheat seed NIAW-301 *(Trimbak)*, NIAW-917 *(Tapowan)* and NIAW-34 *(Niphad-34)* was obtained from Wheat Research Station, Niphad, District- Nasik (MS). The wheat seeds were treated with *Azotobacter* + PSB culture @ 250 g per 10 kg seed for better nitrogen fixation in soil. The seeds were sown by line sowing with distance of 22.5 cm between two rows by using seed rate @ 120 kg ha^{-1}. First, second, third, fourth and fifth sowing were done on 07th November, 21st November, 05th December, 19th December and 2nd January 2012 respectively.

Table 1. Details of treatments with their symbols and treatment combinations.

Sl. No.	Details of treatments	Symbol used
I.	Main plot treatments (sowing dates)	S
1	45 MW (07th Nov 2012)	S_1
2	47 MW (21st Nov 2012)	S_2
3	49 MW (05th Dec 2012)	S_3
4	51 MW (19th Dec 2012)	S_4
5	01 MW (02nd Jan 2013)	S_5
II.	Sub plot treatments (varieties)	V
1	NIAW-301 *(Trimbak)*	V_1
2	NIAW-917 *(Tapowan)*	V_2
3	NIAW-34 *(Niphad-34)*	V_3

Results and Discussion

Plant height (cm)

The mean plant height of wheat was progressively increased with advancement in the age of crop (Table 2). The mean plant height at 15, 30, 45, 60, 75, 90 DAS and at harvest were 7.03, 12.21, 19.96, 44.49, 68.78, 78.59 and 79.84 cm respectively. The highest plant height of wheat was observed in 47 MW and periodically it was significantly higher and it was at par with 45 MW at all growth stages except 15 DAS and 75 DAS. These results indicate that sowing of wheat crop in 47 MW was most suitable for plant height. Similar results were obtained by Pandey et al. [4]. The highest plant height of wheat variety was observed in NIAW-301 which was significantly superior over rest of the cultivars at all growth stages.

Number of tillers (meter^{-1} row length)

The number of tillers (meter^{-1} row length) was significantly influenced due to different sowing dates at all growth phases. The sowing of wheat at 47 MW recorded significantly higher number of tillers. The sowing of wheat at 45 MW performs second best treatment to produce significantly higher number of tillers (meter^{-1}length) than 49 MW, 51 MW and 01 MW. The reduction in number of tillers (meter^{-1} length) might be due to the increase temperature in late sowing at the time of tiller initiation and at the time of tiller survival during later stage of growth. Such adverse effect on number of tillers might be due to late sowing. Similar results were observed by Gill [5] and Mukherjee [6]. The mean number of tillers (meter^{-1} row length) was significantly influenced due to different wheat varieties at all growth stages. The maximum number of tiller (meter^{-1} row length) was found in NIAW-301

Table 2. Growth characters of wheat as influenced periodically by different treatments.

Treatments	Days after sowing: Plant height at harvest	Total number of tillers (meter^{-1} row length)	Mean leaf area plant^{-1} (dm^2)	Days to maturity
A. Sowing dates (S)				
S_1 : 45 MW (07th Nov 2012)	81.27	122.67	0.62	113
S_2 : 47 MW (21st Nov 2012)	82.58	123.67	0.66	111
S_3 : 49 MW (05th Dec 2012)	79.61	120.11	0.54	106
S_4 : 51 MW (19th Dec 2012)	76.84	118.33	0.50	102
S_5 : 01 MW (02nd Jan 2013)	74.52	115.89	0.45	93
SEm ±	0.95	1.20	0.012	0.58
CD at 5%	3.10	3.93	0.039	1.91
B. Varieties (V)				
V_1 : NIAW-301 *(Trimbak)*	81.14	122.67	0.59	108
V_2 : NIAW-917 *(Tapowan)*	78.81	120.67	0.55	105
V_3 : NIAW-34 *(Niphad-34)*	76.94	117.07	0.52	103
SEm ±	0.64	0.93	0.003	0.35
CD at 5%	1.91	2.76	0.010	1.03
C. Interactions (S × V)				
SEm ±	1.45	2.09	0.007	0.78
CD at 5%	NS	6.19	NS	2.31
General mean	78.96	120.13	0.56	105

at all growth stages and which was significantly superior and at par with NIAW-917 at 60 DAS and at harvest. The variety NIAW-34 recorded significantly lower number of tillers at all growth phases than remaining varieties.

Leaf area plant^{-1} (dm^2)

The mean leaf area plant^{-1} at 15, 30, 45, 60, 75 and 90 DAS were 0.29, 0.58, 0.78, 0.94, 1.22 and 0.56 dm^2 respectively. The mean leaf area plant^{-1} of wheat differed significantly due to extended sowing dates at all crop growth stages. This might be due to favorable climatic condition during 45 and 47 MW while during 49, 51 and 01 MW the rise in temperature reduced number of tillers and leaves, this reflects in leaf area. The mean leaf area plant^{-1} of wheat was influenced significantly due to wheat varieties at all growth phases of crop. From the results it was observed that NIAW-301variety of wheat has more genetical potential to enlarge the leaf size during growth period than the rest of the varieties. The interaction effects of wheat sowing dates and varieties at 15, 30, 45, 60, 75 and 90 DAS were found statistically non significant.

Days to 50% flowering and maturity

The mean days required to 50% flowering was 69 and that for maturity was 105 which was observed significantly higher in 45 MW of sowing. Significantly lesser days to 50% flowering and maturity was gradually reducing in each extended sowing dates. The late sowing of wheat usually (49-01 MW) the most of post flowering period coincides with relatively higher temperature that occurred from mid January onward resulted photosynthetic area and duration were reduced senescence of leaves earlier. The results are in harmony with those reported by Pandey et al. [4] and Tyagi et al. [7]. Days to 50% flowering and days to maturity were influenced significantly due to wheat varieties. Maximum number of days required to 50% flowering and days to maturity was observed in variety NIAW-301 significantly higher while NIAW-34 observed significantly lower in these characters. The interaction of NIAW-301, NIAW-917 and NIAW-34 wheat varieties with sowing date of 45 MW (2nd week of November) was recorded the higher days to 50% flowering (76) than rest of treatment combinations. Overall NIAW-301, NIAW-917 and NIAW-34 varieties recorded same days to 50% flowering. The least days to 50% flowering were observed in NIAW-34 (60 days) when interacted with different sowing dates (76, 73, 70, 64 and 62 days respectively). The interaction effects of wheat sowing dates and varieties were found statistically significant for days to maturity. The interaction of NIAW-301 wheat variety with sowing date of 45 MW (2nd week of November) was recorded the higher days to maturity (114) than rest of treatment combinations.

Table 3. Mean grain and straw yields of wheat as influenced by different treatments.

Treatments	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})
A. Sowing dates (S)		
S_1 : 45 MW (07th Nov 2012)	40.33	59.69
S_2 : 47 MW (21th Nov 2012)	43.06	61.61
S_3 : 49 MW (05th Dec 2012)	36.00	54.92
S_4 : 51 MW (19th Dec 2012)	32.33	46.57
S_5 : 01 MW (02nd Jan 2013)	30.06	43.85
SEm ±	0.25	0.38
CD at 5%	0.84	1.26
B. Varieties (V)		
V_1 : NIAW-301 *(Trimbak)*	38.00	55.04
V_2 : NIAW-917 *(Tapowan)*	36.23	53.65
V_3 : NIAW-34 *(Niphad-34)*	34.83	51.30
SEm ±	0.11	0.19
CD at 5%	0.34	0.56
C. Interactions (S × V)		
SEm ±	0.26	0.42
CD at 5%	0.78	1.25
General mean	36.36	53.33

Grain yield

The grain yield of wheat was influenced significantly due to extended sowing dates. The grain yield was maximum (43.06 q ha^{-1}) at 47 MW which was significantly superior over rest of sowing dates. The second best sowing date was 45 MW which produce significantly more grain yield (40.33 q ha^{-1}) over 49 MW, 51MW and 01MW (Table 3). The reduction in grain yield caused due to sowing dates was because of difference in temperature. Sowing date 47 MW was favorable to high grain production because the post anthesis period coincided with relatively low temperature. However, late sowing 49 MW, 51 MW and 01 MW were unfavorable to grain yield since low temperature during early sowing might have adversely affected the emergence and ultimately tillers per running meter. In the late sowing 49 MW, 51 MW and 01MW the period between anthesis and leaf senescence was curtailed by the onset of relatively higher temperature. This result is in corroboration with earlier reporters [6, 8–10]. The grain yield of wheat was influenced significantly due to wheat varieties. The grain yield was significantly higher in NIAW-301 (38.00 q ha^{-1}) and significantly superior over rest of wheat varieties. The variety NIAW-34 recorded significantly lower grain yield (34.83 q ha^{-1}). The difference in grain yield in wheat varieties might be due to inherent genetical potential of wheat varieties. The interaction of NIAW-301 wheat varieties with sowing dates 45 MW, 47 MW, 49 MW, 51 MW and 01MW were recorded significantly higher grain yield (42.33, 44.33, 37.67, 34.50 and 31.17 q ha^{-1} respectively) than the rest of interactions.

Straw yield

The straw yield of wheat was influenced significantly due to extended sowing dates. The straw yield was maximum (61.61 q ha^{-1}) at 47 MW which was significantly superior over rest of sowing dates. The second best sowing date was 45 MW which produce significantly more straw yield over 49 MW, 51 MW and 01 MW. The reduction in straw yield was due to reduced number of plants harvested and reduced growth in terms of plant height and dry matter accumulation. The similar findings were also reported earlier [4, 6, 10, 11]. The straw yield of wheat was influenced significantly due to wheat varieties. The straw yield was significantly higher in NIAW-301 (55.04 q ha^{-1}) and significantly superior over rest of wheat varieties. The variety NIAW-34 recorded significantly lower straw yield (51.30 q ha^{-1}). The interaction of NIAW-301 wheat variety recorded significantly higher straw yield with sowing dates 45 MW, 47 MW, 51 MW and 01 MW except 49 MW (61.77, 63.00, 48.99 and 46.04 q ha^{-1} respectively) than the rest of interactions.

Conclusion

The following conclusions were drawn from the present investigation. Amongst the all sowing times, 47 MW (21st November 2012) recorded significantly higher growth and yield characters. Amongst all the wheat varieties, the NIAW-301 *(Trimbak)* variety was found significantly superior under extended sowing dates with regards to growth and yield (43.06 q ha^{-1}) characters. The interaction effect between sowing time 47 MW (21st November 2012) and variety NIAW-301 *(Trimbak)* recorded significantly higher and fa-

vorable growth and yield (44.33 q ha^{-1}) characters of wheat.

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