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Impact of Different Dates of Sowing on the Growth and Yield of Improved Wheat (*Triticum* spp.) Varieties in Northern Central India

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ABSTRACT: The trials were performed out at the Research Farm, College of Agriculture, RVSKVV, Gwalior (M.P.) in 2013-14 and 2014-15. The treatments comprised two sowing dates (timely and late) and five cultivars (HD 4730, HI 8737, MPO 1215, HD 4728, and HI 8498) replicated three times under a spilt-plot design. The primary plot treatments were the dates of sowing, while the sub-plot treatments were the varieties. All packages of practises were implemented in accordance with wheat crop recommendations. Late seeding reduced growth metrics (plant height (cm), number of leaves/25 cm row length, and number of days to maturity) and yield contributing features (length of spike (cm), grain weight of spike (g), number of spikes/m^2, and test weight (g). Timely seeded crops outperformed late sown crops in terms of biological yield and HI.HD 4728 had the highest values of growth metrics and yield contributing features, whereas variety HI 8498 had the lowest values. Variety HD 4728 surpassed the rest of the varieties in terms of biological yield and HI. Under timely seeded conditions, the interaction of variety HD 4728 resulted in considerably higher values of biological yield per hectare than the other interactions. Variety HD 4728, which was seeded on time, had the greatest net monetary return and B:C ratio (94767/ha and 4.26, respectively), followed by HI 8737, which was also sown on time.

Keywords: Date of sowing, Growth characters, Variety, Yield attributes, Yield.

INTRODUCTION

Wheat, scientifically known as *Triticum aestivum* (L.), holds significant importance as a cereal crop in India. The country predominantly cultivates winter wheat, commencing the planting process from the first week of October until the end of December. Numerous factors contribute to the relatively low average yield of wheat. Consequently, various initiatives have been undertaken to enhance productivity, such as the introduction of high-yielding varieties, the application of balanced fertilizers, and the efficient utilization of irrigation facilities.

The yield of wheat crop is greatly affected by various environmental factors, and one such factor is untimely planting. According to Anderson (2008), the timing of sowing has a significant impact on the growth, yield attributes, grain, and straw yields. Additionally, different varieties of wheat also exhibit variations in both yield and nutrient uptake when planted late (Singh *et al*., 2014). Another crucial aspect is the lack of improved varieties that have shorter maturity and are suitable for late sowing conditions, considering the relatively shorter growing period available for the crop (Tiwari *et al*., 2014). However, recently developed wheat varieties show potential in replacing the older established varieties in the command area. By strategically manipulating the sowing time and utilizing these new varieties, the wheat yield in northern Madhya Pradesh can be significantly boosted.

In the irrigated conditions of the northern part of Madhya Pradesh, wheat is commonly cultivated in a multiple cropping system during the Rabi season. This is primarily due to the delay in harvesting Kharif crops, which in turn leads to a delay in sowing wheat. Consequently, there is a decrease in grain yield ranging from 27 to 33 percent, with an average reduction of 45 kg grain per hectare per day (Sardana *et al*., 2002). Wheat varieties that possess photo and thermo insensitive traits are particularly suitable for a wider range of sowing times in irrigated conditions. These varieties are capable of maintaining a high level of seed yield even when sown late. In order to check variants, new wheat varieties have recently been produced that have better yield potential even when sown later and a higher degree of tolerance to extreme temperatures, illnesses, and insect pests. With the aforementioned information in mind, the current study was conducted to assess how well enhanced wheat varieties performed under irrigated circumstances throughout a larger range

of planting dates in the northern region of Madhya Pradesh's agro-ecosystem.

MATERIALS AND METHODS

The trials were performed out at the Research Farm, College of Agriculture, RVSKVV; Gwalior (M.P.) in the academic years 2013–14 and 2014–15. The field has adequate drainage and a uniform contour.

At an elevation of around 206 metres above mean sea level, Gwalior is located in the northern region of Madhya Pradesh, between 26°13' North latitude and 78°14' East longitude. Summers are dry and hot. May through June sees mean monthly maximum temperatures ranging from 38.5°C to 47°C, while December through January sees mean minimum temperatures ranging from around 0°C to 4°C. The average annual precipitation is approximately 751 mm, which is spread out over a three-month period from mid-June to the end of September. The soil in the experimental plot was classified as sandy clay loam. The experiment consisted of ten different combinations of treatments, including two different sowing dates (timely and late) and five improved wheat varieties (HD 4730, HI 8737, MPO 1215, HD 4728, HI 8498). These treatments were replicated three times using a split plot design. All recommended agricultural practices were followed throughout the growing season. For detailed observations and the study of plant characteristics, five plants were randomly selected from each plot and marked. The technique outlined by Panse and Sukhatme (1967) was followed in the independent analysis of the data acquired on the different traits. For those characters alone, the critical difference (C.D.) value was computed at the 5% significance level.

RESULT AND DISCUSSION

The effects of the experimental variables—sowing dates (D), varieties (V), and their interaction (D x V)—are explained based on pooled data from two years, in the order that they appear in the analysis of variance tables.

A. Growth characters

Table 1 presents the significant impact of sowing dates on various growth parameters, including plant height (cm), number of leaves per 25 cm row length, and number of days to maturity. The growth characteristics exhibited remarkable superiority when the crops were sown in a timely manner compared to late sowing. This can be attributed to the favorable temperature and other climatological conditions during timely sowing, which facilitated optimal plant growth. Conversely, late sowing resulted in delayed emergence of seedlings due to low temperatures during sowing, and early maturity caused by high temperatures during the reproductive phase. These conditions limited the time available for the expression of different phenophases, particularly the grain filling process in the case of late-sown crops (Kumar *et al.,* 2010). These findings align with the research conducted by Singh (2010).

HD 4728 exhibited a remarkable increase in plant height, surpassing all other varieties. It also displayed the highest count of leaves per 25 cm row length and took the longest time to reach maturity. Conversely, HI 8498 recorded the lowest values in terms of growth characteristics. These variations in plant growth can be attributed to the inherent traits of each variety. Ranjana Suresh Kumar (2013) also obtained similar findings in their research.

B. Yield attributes

Sowing dates had a significant impact on various yield attributes, including the number of spikes per square meter, spike length, grain weight of spike, and test weight. The crop sown in a timely manner showed significantly higher values for all these attributes compared to the late-sown crop. The late-sown crop experienced higher temperatures during the reproductive growth phase. Temperature had a complex relationship with spikelet formation, ripening, and grain yield, unlike other weather parameters (Jung *et al.*, 2015). According to Hakala *et al.* (2011), grain number was particularly sensitive to temperature after anthesis. This sensitivity resulted in a general decrease in yield per ear of 3-4 percent for every 1°C increase in temperature above an average of 15°C. The increase in yield characteristics could be attributed to the availability of more time for optimal utilization of growth resources and expression of its potential. In the case of late sown crops, immature and wrinkled grains were produced due to the high temperatures during the milk stage. Conversely, timely sown crops had an advantage as they completed their vegetative growth satisfactorily and entered the earing stage during favourable temperatures. The development and maturity of the grains maintained a favourable balance with the steady rise in temperature, as evidenced by the test weight and number of grains per spike. These findings are consistent with those of Singh (2010).

A higher yield of attributing characters was observed in Variety HD 4728 compared to other varieties, which could be attributed to its genetic characteristics. These findings are consistent with the research conducted by Chaudhary and Singh (2007); Ranjana Suresh Kumar (2013).

Yield. Late sown crops exhibited a significantly lower biological yield and harvest index (HI) compared to timely sown crops, as indicated in Table 2. The superior biological yield and higher HI observed in timely sown crops can be attributed to enhanced plant growth, resulting in increased growth and yield attributes, bold grains, and improved partitioning of photosynthates. This finding is consistent with the study conducted by Chen *et al*. (2010), where the highest yield was obtained from timely sown wheat crops, while poorer grain and straw yield were obtained from late sown crops. These results further support the findings of Dubey *et al*. (2008).

Variety HD 4728 exhibited a significantly higher value of biological yield and HI per hectare, whereas variety HI 8498 showed an inferior value.

The interaction of variety HD 4728 under timely sown conditions resulted in significantly higher values of biological yield per hectare compared to other

interactions. These findings are consistent with the studies conducted by Chourasiya *et al.* (2013); Nagarjuna *et al*. (2014).

The observed variations in growth parameters, yield attributes, and genetic characteristics contributed to the differences in yield among the varieties. These results also support the research findings of Chaudhary and Singh (2007).

Economics. In comparison to late sowing, all the different varieties showed higher net monetary return and B:C ratio when sown on time (Table 3). Among the varieties, HD 4728 exhibited the highest value of net monetary return and B:C ratio (₹94767/ha and ₹4.26; respectively) when sown timely, followed by HI 8737. These results suggest that there was a better allocation of photosynthates in the respective crop conditions. Furthermore, these findings are consistent with the studies conducted by Chourasiya *et al.* (2013); Nagarjuna *et al.* (2014).

Table 1: Growth and yield attributing characters of wheat as influenced by sowing dates and varieties (pooled).

Treatments	Plant height (cm)			Number of leaves/25 cm row length			Number of days to maturity			Length of spike (cm)			Grain weight of spike (g)		
	At harvest			At harvest											
Date of sowing / Varieties	**Timely**	**Late**	**Mean**	**Timely**	**Late**	**Mean**	**Timely**	**Late**	**Mean**	**Timely**	**Late**	**Mean**	**Timely**	**Late**	**Mean**
HD 4730	77.59	73.18	**75.39**	21.18	16.00	**18.59**	139.45	132.93	**136.19**	9.22	7.51	**8.37**	1.53	1.26	**1.39**
HI 8737	81.38	74.12	**77.75**	22.00	18.66	**20.33**	141.16	135.08	**138.12**	9.98	8.65	**9.32**	1.66	1.37	**1.51**
MPO 1215	75.96	71.64	**73.80**	19.99	12.56	**16.28**	137.83	131.00	**134.42**	8.69	7.03	**7.86**	1.26	1.07	**1.17**
HD 4728	83.11	80.75	**81.93**	23.13	19.83	**21.48**	143.33	136.33	**139.83**	10.95	9.37	**10.16**	1.85	1.49	**1.67**
HI 8498	74.14	66.64	**70.39**	18.50	10.50	**14.50**	136.52	129.86	**133.19**	8.35	6.68	**7.51**	1.18	1.04	**1.11**
Mean	**78.44**	**73.27**		**20.96**	**15.51**		**139.66**	**133.04**		**9.44**	**7.85**		**1.50**	**1.24**	
Comparing the mean of	**S.E. (m) ±**	C.D. (at 5%)		**S.E. (m) ±**	C.D. (at 5%)		**S.E. (m) ±**	C.D. (at 5%)		**S.E. (m) ±**	C.D. (at 5%)		**S.E. (m) ±**	C.D. (at 5%)	
Dates of sowing	0.66	1.82		0.58	1.61		1.34	3.71		0.19	0.52		0.04	0.10	
Varieties	1.46	2.98		1.16	2.36		2.43	NS		0.36	0.73		0.07	0.14	
D × V	1.96	NS		1.58	NS		3.35	NS		0.49	NS		0.10	NS	

Table 2: Yield attributes and yield of wheat as influenced by sowing dates and varieties (pooled).

Treatments	Grain test weight (g)			Number of spikes/m^2			Biological yield (kg/ha)			Harvest Index (%)		
Date of sowing / Varieties	**Timely**	**Late**	**Mean**	**Timely**	**Late**	**Mean**	**Timely**	**Late**	**Mean**	**Timely**	**Late**	**Mean**
HD 4730	36.98	33.11	**35.05**	325.62	313.23	**319.43**	13877	11171	**12524**	41.92	41.53	**41.73**
HI 8737	38.28	34.99	**36.64**	333.22	319.45	**326.33**	14142	11239	**12690**	41.53	43.22	**42.38**
MPO 1215	33.60	30.42	**32.01**	318.68	307.12	**312.90**	9806	7022	**8414**	42.53	43.45	**42.99**
HD 4728	39.54	37.43	**38.48**	339.20	320.35	**329.78**	14577	12928	**13752**	40.88	41.72	**41.30**
HI 8498	32.83	30.97	**31.90**	315.28	288.03	**301.66**	9202	6650	**7926**	43.08	43.67	**43.37**
Mean	**36.24**	**33.38**		**326.40**	**309.64**		**12321**	**9802**		**41.99**	**42.72**	
Comparing the mean of	**S.E. (m) ±**	C.D. (at 5%)		**S.E. (m) ±**	C.D. (at 5%)		**S.E. (m) ±**	C.D. (at 5%)		**S.E. (m) ±**	C.D. (at 5%)	
Dates of sowing	0.48	1.34		2.04	5.65		103	285		0.11	0.31	
Varieties	1.32	2.69		7.31	14.89		175	356		0.52	1.07	
D × V	1.74	NS		9.47	NS		243	528		0.67	NS	

Table 3: Economics of different treatments as influenced by interaction of sowing dates and varieties of wheat.

Sr. No.	*Treatment combination*	Cost of Cultivation (₹/ha)	Net monetary return (₹/ha)	B:C Ratio (₹)
1.	Timely × HD 4730	29109	90388	4.11
2.	Timely × HI 8737	29109	92066	4.17
3.	Timely × MPO 1215	29109	55974	2.93
4.	Timely × HD 4728	29109	94767	4.26
5.	Timely × HI 8498	29109	51319	2.77
6.	Late × HD 4730	29109	66597	3.29
7.	Late × HI 8737	29109	69281	3.39
8.	Late × MPO 1215	29109	32540	2.13
9.	Late × HD 4728	29109	81919	3.82
10.	Late × HI 8498	29109	29407	2.02

Note: Grain price @ ₹1500/q and Straw price @ ₹400/q

CONCLUSIONS

Significantly inferior values of growth parameters, yield attributing characters and biological yield were obtained when the crop sown late. Whereas, superior values of same aforementioned characters were obtained when the crop sown on time, it reflects the effect of conducive environmental conditions on the

agronomic performance of wheat. Therefore, timely sowing must be done in order to avoid the significant yield loss, along with, variety HD 4728, followed by HI 8737 can be adopted for higher yield and higher net returns.

FUTURE SCOPE

The improved wheat varieties identified in the research results may be adopted for increasing grain yield as well as income at farm.

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Conflict of Interest. None.

REFERENCES

Anderson, R. (2008). Growth and yield of winter wheat as affected by preceding crop and crop management. *Agronomy Journal*, *100*(4), 977-980.

Chaudhary, S. and Singh, V. P. (2007). Evaluation of wheat (*Triticum aestivum* L.) genotypes at different dates of sowing under irrigated conditions. *Agronomy Digest*, *10*, 6-7.

Chen, S., Zhang, X., Ren-zhao, M., Wang, Y., & Sun, H. (2010). Effect of sowing date and rate on canopy intercepted photo-synthetically active radiation and yield of winter wheat. *Chinese Journal of Eco-Agriculture*, *17*(4), 681-685.

Chourasiya, Ajay, Tomar, S. S., Tomar, S. P. S., Tomar, S. S. and Srivastava, S. C. (2013). Response of wheat (*Triticum aestivum*) varieties to sowing dates in Gird region of Madhya Pradesh. *Current Advances in Agricultural Sciences*, *5*(1), 129-131.

Dubey, A. P., Singh, C. B., Khan, Naushad, Yadav, P. N. and Tiwari, A. N. (2008). Influence of weather parameters on wheat yield under varying sowing dates. *CAB Abstracts Journal of Agrometeorology*, *10*(2), 457-461.

Hakala, K., Jauhiainen, L., Himanen, S., Rötter, R. P., Salo, T., & Kahiluoto, H. (2011). Sensitivity of barley varieties to weather in Finland. *The Journal of Agricultural Science*, *150*(2), 145-160.

Jung, W., Lee, K., & Lee, B. (2015). Responses of spikelet fertility to air, spikelet, and panicle temperatures and vapor pressure deficit in rice. *Journal of Crop Science and Biotechnology*, *18*(4), 209-218.

Kumar, U., Joshi, A. K., Kumari, M., Paliwal, R., Kumar, S., & Röder, M. S. (2010). Identification of qtls for stay green trait in wheat (*Triticum aestivum* L.) in the 'chirya 3' × 'sonalika' population. *Euphytica*, *174*(3), 437-445.

Nagarjuna, D., Bhale, V. M. and Srinivasarao, M. (2014). Effect of sowing dates on yield attributes and yield of different new wheat (*Triticum dicoccum*) genotypes under Peninsular India. *Environment and Ecology*, *32*(3A), 1025-1030.

Panse, V. G. and Sukhatme, P. V. (1967). Statistical Method for Agricultural Workers. ICAR, New Delhi, pp: 97-151.

Ranjana Suresh Kumar (2013). G × E interaction over extended dates of sowing for grain yield and its attributing traits in wheat (*Triticum aestivum* L.). *A nnals of Biological Research*, *4*(1), 238-241.

Sardana, Virender, Sharma, S. K. and Randhawa, A. S. (2002). Performance of Wheat varieties under different sowing dates and nitrogen levels in the sub-montane region of Punjab. *Indian Journal of Agronomy*, *47*(3), 372-377.

Singh, K. (2010). Agronomic performance of new wheat varieties for different dates of sowing in Northern Madhya Pradesh. M.Sc. (Ag.) Thesis (Unpublished), RVSKVV, College of Agriculture; Gwalior.

Singh, V., Solanki, Y., & Redhu, A. (2014). Phenological development, grain growth rate and yield relationships in wheat cultivars under late sown condition. *Indian Journal of Plant Physiology*, *19*(3), 222-229.

Tiwari, M., Choudhary, S., Manjhi, M., & Swarnakar, V. (2014). Compare the yield of wheat varieties provided under naip (National Agricultural Innovation Project) through iari (indsian agricultural research institute) in dhar district of Madhya Pradesh, India. *Iosr Journal of Agriculture and Veterinary Science*, *7*(8), 37-40.

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