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Effect of different sowing dates on yield and economics of wheat cultivars under North situations of Madhya Pradesh

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Abstract
A field experiment was conducted during *Rabi* season of 2015-16 at Research Farm, School of Agriculture ITM University Gwalior (MP). The treatments consisted of 2 dates of sowing *i.e.*; D1 (15th November) and D2 (10th December); and 5 varieties *i.e.*; V1 to V5 (HD 4730, PBW-343, Raj 4037, HD 4728 and Lok-1). The experiment was conducted in spilt-plot design with three replications. The experimental results revealed that Maximum grain yield (5027.82 kg ha^{-1}), straw yield (6962.84 kg ha^{-1}), gross monetary returns (110592 Rs. ha^{-1}), net monetary returns (80378 Rs. ha^{-1}) and benefit cost ratio (3.66) were recorded under variety HD 4728 at 15th November sowing date compared to other varieties and dates of sowing.

Keywords: Economics, performance different varieties, sowing times on growth

Introduction
Wheat (*Triticum aestivum* L.) belongs to family "Poaceae" and genus "*Triticum*". It is an essential grain food component and is a very important commodity among cereal crops (Montazeri *et al.*, 2005) [3]. A total 17% world's cropped area is under wheat cultivation which together adds 35% of the staple food and 20% of the calories (Chhokar *et al.*, 2006) [4]. In India on an area of about 29.58 million hectares under wheat with the production of 99.70 million tonnes and the productivity of 33.71q ha^{-1} (Anonyms, 2018) [1]. In state of Madhya Pradesh, it is grown in 5.56 million hectare area with the production of 15.91million tonnes and share in all India production is 15.96 % (Agricultural Statistics, 2016) [2]. The sowing time plays an important role among various agronomic factors, which 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 provides an opportunity to accumulate more biomass as compared to late sowing, hence manifested in higher grain and biological yields (Singh and Pal 2003) [5]. However, the higher protein yield, grain protein content, dry gluten content, beta carotene content and sedimentation index in late sown wheat have been reported by (Zende *et al*. 2005) [6]. In the northern part of Madhya Pradesh, wheat is generally grown in multiple cropping systems during *Rabi season.* Due to delay in harvesting of *Kharif* crops sowing of wheat, is generally delayed. Consequently, there is reduction in grain yield from 27 to 33 per cent with mean reduction of 45 kg grain ha^{-1} day^{-1} (Sardana *et al.*, 2002) [7]. Therefore present study, Performance of different varieties under extended sowing times on growth, yield and economics of wheat (*Triticum aestivum* L.) was under taken.

Materials and methods
A field experiment was conducted during *Rabi* seasons of year 2015-16 at experimental farm, School of Agriculture, ITM University, Gwalior, Madhya Pradesh. The experiment was conducted in split plot design with two sowing times as a main plot treatment and five varieties as sub plot treatments with three replication. The treatment comprised of two dates of sowing i.e. 25th November and 10th December in main plots and five wheat varieties namely HD 4730, PBW 343, Raj 437, HD 2733, HD 4728 and Lok-1 in sub plots. The soil of the experimental area was sandy loam soil, neutral in reaction (pH 7.9), medium in organic carbon

content (0.30 %), normal in electrical conductivity (0.25 dS/m), medium in available N (257.13 kg ha^{-1}) and P (11.38 kg ha^{-1}) and high in available K (291.14 kg ha^{-1}). Sowing was carried out by drilling with spacing of 22.5 cm. The seeds were covered immediately after sowing. The sowing was carried out at two different times as per treatment. Recommended dose of fertilizer *i.e.* 120: 60: 40 kg. N, P_2O_5, and K_2O per hectare were given. However N applied in two splits doses. Five plants from each net plot were randomly selected and labeled for taking biometric observations. The same five plants were harvested separately for post-harvest studies.

Result

Grain yield, straw yield and biological yield (kg ha^{-1})

Sowing on 15th November significantly recorded the maximum grain yield (5027.82 kg ha^{-1}), straw yield (6962.84 kg ha^{-1}) as compared to 10th December sown crop (4003.66 kg ha^{-1}). Varieties also showed significant differences in their grain yield (kg ha^{-1}), Variety (HD 4728) recorded the highest grain yield (5570.93 kg ha^{-1}), straw yield (7879.30 kg ha^{-1}) over all other varieties. Lowest grain yield (3247.20 kg ha^{-1}) was observed in (Lok-1).Interaction effect between dates of sowing and varieties was non-significant for the straw yield (kg ha-1).

Interaction effect between dates of sowing and varieties was significant. Variety (HD 4728) under 15th November and 10th December were sown resulted in significantly higher grain yield (kg ha-1) over other varieties. As a result, the treatment combinations D1V4 (variety (HD 4728) sown on 15th November) produced significantly highest grain yield (5874.73 kg ha-1) over rest of the treatment combinations.

Harvest index per cent

The harvest index increased significantly with delay in sowing after 15th November (Table no. 1). Varieties showed significantly differences in their harvest index. (Lok-1) recorded the highest harvest index (43.06 per cent), which was at par with (RAJ-4.37). Significantly lowest harvest index (41.44 per cent) was noted in (HD 4728).

The higher grain yield in normal sown crop may be attributed to better plant growth leading to significantly more growth and yield attributes, bold grains and better partitioning of photosynthesis compared to its delayed sowing. Kumar *et al.* (1994) [8] also obtained highest yield from early sown wheat crop whereas poorer grain and straw yields were obtained from late sown wheat. These results also corroborate the findings of Dhaka *et al.* (2006) [9] and Dubey *et al.* (2008) [10].

Table 1: Grain, straw, biological yield and harvest index as influenced by sowing dates and varieties

Date of sowing	Biological Yield (kg ha^{-1})	Grain yield Kg ha^{-1}	Straw yield kg ha^{-1}	Harvest Index (%)
15th November	11990.66	5027.82	6962.84	42.06
10th December	9434.25	4003.66	5430.59	42.58
S.Em.	135.34	49.60	86.30	0.08
CD at 5%	375.15	137.49	239.22	0.52
Varieties				
HD 4730	12189.80	5086.81	7102.98	41.73
PBW-343	12385.14	5249.82	7135.32	42.48
RAJ-4037	7991.84	3423.93	4567.91	42.89
HD 4728	13450.23	5570.93	7879.30	41.44
Lok-1	7545.29	3247.20	4298.08	43.06
S.Em.	173.62	67.55	108.92	0.14
CD at 5%	481.25	187.25	301.89	0.42
Date of sowing and varieties				
S.Em.	439.24	170.90	275.54	0.35
CD at 5%	S	S	NS	S

Economics of treatments

Data given in Table 2 indicated that effectiveness of any production system is ultimately evaluated on the basis of its economics. Economic analysis is the basic consideration in determining that which treatment gives the highest return while marginal analysis indicates the relative contribution of additional expenditure. Economic analysis promised that maximum net return of (Rs. 80378 ha^{-1}), gross monetary return (Rs. 110592 ha^{-1}), and benefit cost ratio (3.66) was obtained from D1V4 (T_4).

Table 2: Economics of the treatments as influenced by sowing dates and varieties

	Cost of Cultivation (Rs ha^{-1})	Gross Return (Rs ha-1)	Net Return (Rs ha-1)	B:C Ratio
D1V1	30214.00	105874	75660	3.50
D1V2	30214.00	107801	77587	3.57
D1V3	30214.00	75578	45364	2.50
D1V4	30214.00	110592	80378	3.66
D1V5	30214.00	70560	40346	2.34
D2V1	30214.00	84788	54574	2.81
D2V2	30214.00	87994	57780	2.91
D2V3	30214.00	51691	21477	1.71
D2V4	30214.00	98717	68503	3.27
D2V5	30214.00	49969	19755	1.65
Average	30214.00	84356.81	54142.81	2.79

Conclusion

For better yield and economics of wheat, the crop can be sown in 15 November. Also variety HD 4728 was found better as compared to all other varieties under study.

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