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Effect of sowing dates on yield and yield components of wheat in Maharajganj district Eastern U.P

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Abstract
An experiment was conducted during Rabi seasons of 2019-20 and 2020-21 Krishi Vigyan Kendra, Maharajganj, Eastern U.P. conducted 30 acre sowing date demonstration on wheat crop at farmers field of three adopted villages to study the effect of sowing dates of sowing (15th November and 15th December) on growth, yield attributes and yield of wheat variety (K 1317) on a sandy loam soil at Maharajganj district, eastern Uttar Pradesh, India. Wheat sown on 15th November recorded significantly highest plant height, tillers/m2, grain yield. The results of sowing date revealed that average yield of 41.46 q/ ha was first sowing and second sowing grain yield was recorded 36.11q/ha, village obtained in Bisohhor, Basuli and Raipur blocks of Nichlol district Maharajganj. The yield was found to be 14.82 percent higher over the second sown. The lowest values of technology gap indicate the more feasibility of the technology gap from 13.55 percent. indicated that the demonstrated technologies were feasible in improve the yield of the vegetables. The benefit cost ratio from 3.45 first date of sowing while BC ratio for second date of sowing from 2.73.

Keywords: wheat crop, dates of sowing, yield, technology gap, BC ratio, extension gap

Introduction
Wheat is one of the most important foods of India as well as Uttar Pradesh and is the second most important crop after rice in India and occupies approximately 29.9 million hectares with production of 94.9 million tonnes (FAO 2014) [8]. In Himachal Pradesh, this crop is presently being cultivated on 0.341 million hectare with a production of 0.680 million tonnes and productivity of 1944 kg ha-1 (Anonymous 2013-14) [2]. Date of sowing is most important factors that govern the phenological development of the crop and also efficient conversion of biomass into economic yield. Wheat yield is quite sensitive to late sowing. The late sowing of wheat could be due to many reasons such as presence of previous crops such as rice, cotton and sugarcane in the field, water stress fertilizer and pure seed at the time of sowing (Sial *et al*., 2009; Mirbahar *et al*., 2009) [14, 10]. Wheat planted late usually faces high temperature during its grain filling period which ultimately results into lower crop yield. (Akhtar *et al*., 2006) [1] reported that mid November sown wheat could produce maximum yield (3.05 ton/ha) as compared to early (mid-October) and late (mid-late December) sown (2.35 ton/ha). Delayed wheat planting resulted in serious decline in grain yield (De, *et al*., 1983; Sial *et al*., 2005; Arain *et al*., 1999) [7, 13, 3]. Elevation in temperature accelerates plant development while growth rate declined showing decline in leaf size, tillering capacity and spike size which ultimately result in low yield. (Mullarkey & Jones, 2000; Sial *et al*., 2001) [11, 12]. This not only affects yield, but also affects the yield components and other aspects of the growth and development of wheat. Tahir *et al*. (2009) [16] reported that delay in sowing affects germination, growth, grain development and produces poor tillering due to winter injury in low temperature and suppressed the yield. It is generally associated with a reduced kernel weight (Radmehr *et al*. 2003) a reduced number of spikes per plant and per unit area (Stapper and Fischer, 1990) [15] harvest index, grain number per spike, and leaf area index (Jessop and Ivins, 1970) [9]. High temperature in early stage of growth of crop affects node extension, ear development while temperature stress at anthesis causes premature leaf senescence, affect fertility and reduces grain development (Wardlaw *et al*., 1980).
However, most of the sowing date demonstrations results have been presented in the form of yield and economic advantages and hence, quantification of yield gap minimized because of the such demonstrations becomes an important area of investigation.

Materials and Methods

A field experiment on wheat crop was conducted during 2019-20 and 2020-21 Rabi seasons (Nov.- April) Krishi Vigyan Kendra Basuli, Maharajganj, Achrya Narendra Dev University of Agriculture and Technology, Kumarganj, Ayodhya at farmers field of Mahrajganj district . Village obtained in Bisohhor,Basuli and Raipur blocks of Nichlol district Mahrajganj.The soil texture was sandy loam. The soil was rich in organic carbon, rated as high in total nitrogen, medium in available phosphorus and high in potassium in the upper 0-15 cm layer. Field experiment comprising of two dates of sowing (15th November and 15th December) and one variety (K 1317) was conducted in split plot design with one farmer one replications. Sowing was done at spacing of 22.5 cm. Total 30 sowing date demonstrations were conducted in different village's viz. Bisobhor,Basuli and Raipur 30 farmer's on 12 ha lands. Each sowing date demonstration was laid out on 0.4 ha area while adjacent 0.4 ha.

Soil Analysis

The soil sample was taken before sowing and analyzed with the standard procedures. International Pipette method as described by Piper (1966) was adopted for the analysis of soil separates. Determination of pH was done with the help of Elicodigital pH meter using soil water suspension in the ratio of 1 :2.5.EC was determined in 1:2.5 soil water suspensions with the help of conductivity meter (Jackson, 1967).Organic carbon was determined by Walkley and Black's rapid titration method as described by Jackson (1967).Available nitrogen was estimated by Alkaline potassium permanganate method as described by Subbiah and Asija (1956). Available phosphorus was determined calorimetrically extracting by 0.5 M $NaHCO_3$ (pH 8.3) extractant as given by Olsen *et al.* (1954).Available potassium was first extracted by using 1 NNH_4 OAC (pH 7.0) Morgan's solution and estimated by Flame photometer as described by (Jackson, 1967).

Amendments for soil surface crusting: To tide over the soil surface crusting apply lime at the rate of 2t /ha along with FYM at 12.5 t/ha. The crop was fertilized @120:60:40 of N, P2O5, K2O kg/ha, of which half dose of the nitrogen and full dose of phosphorus and potassium was applied as a basal dose and remaining half of nitrogen was applied in two equal splits, first at maximum tillering and second at earing stage. The crop was irrigated twice along with one pre sowing irrigation. During the crop season.Treat the seeds with Carbendazim or Thiram @ 2 g/kg of seed 24 hours before sowing (or) with talc formulation of Trichoderma viride @ 4g/kg of seed (or) Pseudomonas fluorescens @ 10 g/kg seed. The wheat crop was sown at 22.5 cm (row-row) apart in line using seed rate of 100 kg/ha in 15th of November and 15th of December during both the years. Crop was harvested on the same time of harvesting of plots. Before conduct the demonstration training to farmers of respective village was imparted with respect to envisaged tec In addition to this, data on farmer practices were also collected from the equal area. The benefit cost (B:C) ratio was calculated based on gross return. The following formulae were used to calculate the parameters as suggested by (Das *et al*. 1998) [5]:

1. Increase in grain Yield= Grain yield from Demo plot– Grain yield from FP plot /Grain yield from Demo plot X 100
2. Net Return= Gross Return – Cost of cultivation
3. Benefit/ Cost Ratio= Gross Return / Cost of Cultivation X 100

The responses were recorded and converted in to mean percent score and ranked accordingly as per (Warde *et al*. 1991) [19]. From front line demonstration plots and farmers practice plot (control plot) and finally extension gap, technology gap, and technology index were calculated as given as formula suggested by (Samui *et al*. 2000 and Dayanand *et al*. 2012) as given below.

1. Technology gap = Potential yield – Demonstration yield
2. Extension gap = Demonstration yield – farmers yield
3. Technology index = [(Potential yield – Demonstration yield) /Potential yield] x 100

Results and Discussion

Growth

15th November sown wheat took recorded significantly taller plant height (89 and 92 cm) followed by 15th November (65 & 71 cm) 15th December respectively during both the years due to favourable weather conditions and crop growing period in optimum sowing dates i.e timely sown 15th November (Table 1). Late sowing also resulted in lesser growth period which forced the crop to flower earlier and also mature earlier which again resulted in lesser plant height. (Tewari and Singh 1995) [17]. and (Tahir *et al*. 2009) [16] also recorded similar results. Sowing date had significant effect on number of tillers. 15th November sowing produced significantly higher number of tillers compared to second of sowing at all stages. There was a progressive decrease in number of tillers as the sowing date was delayed 15th December. Dry mater was significantly higher in 20th November sown crop as compared second sowing dates 20th December sown crop at harvest. The greater reduction in total dry matter and its apportioning in plant under delayed sowing were due to drop in temperature during vegetative phase and sharp rise in temperature during reproductive and maturity phases. The increased temperature during reproductive phase under delayed sowing was due to early completion of the required heat units for anthesis and maturity. These results are in conformity with earlier findings of (Tyagi *et al*. 2004) [8].

Yield

A perusal of data in Table 2 revealed that 15th November sowing, remaining at par with 15th December sowing, resulted in significantly higher grain yield during both the years of study. The highest yield recorded with 20th November sowing was (4146kg/ha) due to significantly higher effective tillers, spike length and grains per spike as well as 1000-grain weight while lowest yield recorded during second date of sowing (20th December) was due to the lowest value of all these yield attributes which may be result of the least time taken to maturity as compared to other date of sowing. The decline in grain yield with delay in sowing may be due to forced maturity of late sown wheat, reduction in dry matter accumulation (Table 2). Moreover, the yield attributes like effective tillers, grains ear-1 and 1000- grain weight were reduced under delayed sowing which may be responsible for lesser grain yield (3611kg/ha). The percentage increase in the yield first date of sowing was 14.82% over second date of sowing.

Extension gap, Technology gap, Technology index, Economics: The technology gap which shows the gap in the second date of demonstration yield over potential yield was 13.50, respectively presented in table 3. The technology index is 26.53 and 22.73 percent during two years study, respectively which shows the good performance of 15th November sowing of Mahrajganj conditions. The economic viability of first date of sowing demonstrated technology over second date of sowing was calculated depending on prevailing price of inputs and outputs cost and represented in the term of B:C ratio (table 1 and 3 & figure 1). It was found that the cost of production of wheat under first date of sowing demonstration with an average Rs. 28355 under control. The additional cost increased in demonstration was mainly due to more cost involved in balanced fertilizer, weed control, irrigation. The cultivation of wheat under first date of sowing gave average net return of Rs. 80317/ha which was lower Rs. 70405 in second date of sowing. The benefit cost ratio of wheat first date of sowing with an average of 3.45 in demonstration plots and 2.73 second date of sowing.

Table 1: Effect of sowing dates on growth attributes

Year	Area (ha)	Potential grain yield (q/ha)	Plant height (cm) (At harvest)		Tillers m-2 (No.) (Earing)		Grain Yield (q/ha)		% increase over FP	Extension gap (q/ha)	Technology gap (q/ha)	Technology index
			Timely Sowing	Late sown	Timely Sowing	Late sown	Timely Sowing	Late sown				
2019-20	12	55	89	65	256	201	40.41	35.10	15.13	5.31	14.59	26.53
2020-21	12	55	92	71	269	207	42.50	37.11	14.52	5.39	12.50	22.73
Mean	12	55	91	68	263	204	41.46	36.11	14.82	5.35	13.55	24.63

Table 2: Effect of sowing date on yield and yield attributes of wheat

Year	Grains/spike (No.)		1000-grain weight		Length of spike (cm)		Grain yield (kg/ha)		Straw yield (kg/ha)		Harvest Index	
	Timely Sowing	Late sown	Timely Sowing	Late sown	Timely Sowing	Late sown	Timely Sowing	Late sown	Timely Sowing	Late sown	Timely Sowing	Late sown
2019-20	44	36	49.4	37.9	11.3	10.0	4041	3510	6710	5310	0.38	0.39
2020-21	42	34	44.6	39.3	11.8	10.3	4250	3711	6987	5686	0.38	0.39
Mean	43	35	47.0	38.6	11.6	10.2	4146	3611	6849	5498	0.38	0.39

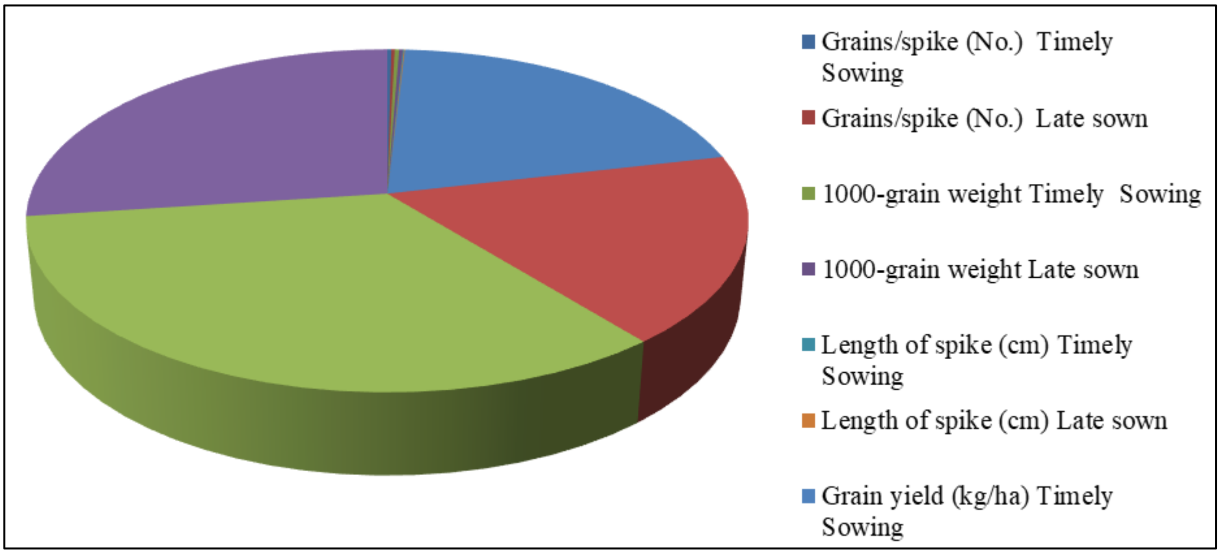

Fig 1: Effect of sowing date on yield and yield attributes of wheat

Table 3: Effect of sowing date on yield and economics of wheat.

Year	Area (ha)	Potential grain yield (q/ha)	Cost of cash input		Additional cost in demonstrations (Rs./ha)	Sale price of grain (MSP) (Rs./qt)	Grain Yield (q/ha)		Total returns Rs. (ha		Extra returns	Incremental Benefit: Cost ratio	
			Timely Sowing	Late sown			Timely Sowing	Late sown	Timely Sowing	Late sown		Timely Sowing	Late sown
2019-20	12	55	27300	25200	2811	1925	40.41	35.10	77789	67568	10222	3.37	2.68
2020-21	12	55	29410	26451	3160	1975	42.50	37.11	83938	73292	10645	3.54	2.77
Mean	12	55	28355	25826	2986	1950	41.46	36.11	80837	70405	10433	3.45	2.73

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