International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(6): 2322-2325

Received: 11-09-2018
Accepted: 13-10-2018

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Effect of different sowing date and varieties on growth, yield attributes and yield of wheat in central plain zone of UP

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Abstract
A field experiment was conducted in Rabi season during 2013-14 on the entitled "Effect of sowing date and varieties on growth, yield and yield attributes of wheat in Central plan Zone of U.P." in sandy loam soil at Students Instructional Farm of C.S. Azad University of Agriculture and Technology, Kanpur-208002 (U.P.). The experiment consisted of sixteen treatment combinations comprised of four sowing date on November, 30**,** December, 10, December, 20 and December, 30 and four variety viz**.,** PBW-343 find out yielded the other varieties K-307, Mahi, HUW-234 for the reason that No. of grain/ear, grain wt/ear and test weight was more in this variety as compared to other three varieties. Results reveal that significant influence with higher grain yield (44.58q/ha) under sowing on 30 November. It was significantly superior over sowing on 10 December (41.08 q/ha), 20 December (35.42 q/ha) followed by sowing on 30 December (32.33 q/ha). The varieties PWB-343 was superior to K-307, Mahi and HUW-234, respectively, from yield point of view and its attributes Regarding selection of varieties under four dates tested in the study was also very clear that sequence of varieties in order of preference was PWB-343, K-307, Mahi HUW-234. The study also confirmed that consequent delay in sowing significantly decreases the yield irrespective of varieties. Thus it is recommended that wheat crop may be sown in month of November to obtain the higher yield.

Keywords: Wheat, dry matter production, yield attributes, grain yield and sowing date

Introduction
Wheat (*Triticum aestivum* L.) is most staple and second most important crop after rice in India, which contributes nearly one third of the total food grains production. It is consumed mostly in the form of bread as 'Chapati'. Wheat is grown in India in an area of about 31.2 Million ha. With a production of 95.9 Million tones and normal productivity of 3.08 tonnes/ha. The major Wheat producing States are Uttar Pradesh, Punjab, Haryana, Madhya Pradesh, Rajasthan, Bihar, Maharashtra, Gujarat, Karnataka, West Bengal, Uttarakhand, Himachal Pradesh and Jammu & Kashmir. These States contribute almost hundred per-end exception of total Wheat production in the country. Remaining States, namely, Jharkhand, Assam, Chhattisgarh, Delhi and other North Eastern States contribute only about 0.5% of the total Wheat production in the country. (Anonymous, 2013-14) [1]. Wheat production in India was about 9.6 million tons in 2013-14. In early nineties india was the fourth largest producer of wheat in the world with 72.6 million tones production from 22.3 million hectare land. Uttar pradesh with 30.25 million tones production during 2013-14 continues by Punjab (17.04 million tons) and Haryana (11.80 million tons). The Rabi crops data released recently by the Directorate of Economics and Statistics indicates that although the total area coverage has declined, area under wheat has gone down marginally by 2.5 per cent. Nevertheless, for 2014-15, the CSO has estimated a positive growth rate of 1.1 per cent for agriculture despite lower rainfall that was only 88 per cent of long-period average, and following a bumper year in 2013-14. (Economic Survey of India, 2014) [1]. Wheat is grown in a variety of soils of India. Soils with a clay loam or loam texture, good structure and moderate water holding capacity are ideal for wheat cultivation. Heavy soils with good drainage are suitable for wheat cultivation under dry conditions. These soils absorb and retain rain water well. Heavy soils with poor structure and poor drainage are not suitable as wheat is sensitive to water logging. Wheat can be successfully grown on lighter soils provided their water and nutrient holding capacity are improved.

Materials and Methods

The experiment was laid out at Student's Instructional Farm of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.) India during *Rabi* season during 2013-14. The field was well leveled having assured irrigation and drainage facilities. Geographically, Kanpur is situated in subtropical region. It is situated at an elevation of 125.9 meter above mean sea level, $26^0$39'35" North latitude and $80^0$18'25" East longitude. It is situated in the alluvial belt of indo-gangetic plain in the Central Part of Uttar Pradesh, which comes into central plain zone. Normally, the climate of the area is semi-arid with hot summer, moderate rainfall and cold winter. The Split Plot Design (SPD) was used in conducting in experiment. Nine treatments combination comprised of three sowing date/sowing temperature *viz.* crop sown on November 30 at mean temperature of 17.7 ^{0}C (D_1). Crop sown on Dec. 10 at mean temperature of 17.2^{0}C (D_2), crop sown on December 20 at mean temperature of 12.8 ^{0}C (D_3) and crop sown on December 20 at mean temperature of 12.8 ^{0}C (D_4) along with three varieties *i.e.* PBW-343, K-307, Mahi and HUW-234 were kept sub-plot treatment with three replication, plant spacing 22.5 cm row to row. An uniform recommended dose of 120 kg N,60 kg P_2O_5 and 60 kg K_2O/ha was applied for wheat crop through urea, DAP and Murate of potash as basal, respectively. Rest half dose of N was top dressed in two equal split does at tillering and panicle initiation stages. The soil texture may be experimental was sandy loam having PH 7.7. Organic carbon 0.47%, available nitrogen 223kg/ha, available P2O5 12.6 kg/ha and available K2O 155kg/ha. The growth, yield attributes and grain yield were recorded for all treatments at time of harvest crop. The dry matter production at harvest was computed dividing seed yield.

Result and Discussion

Effect of varieties on growth, yield and yield attributes of wheat

Growth parameters

The Plant height of different stages (CRI, panicle, anthesis, & maturity) as is cleared is very distinct & the first date under all stages have recorded the maximum height up to maturity. This may also be due to the congenial weather condition and best use of available soil moisture in maximum elongation period. The crop period due to first, second, third and fourth date of sowing has been decreasing, respectively, which makes it clear that the first date has enjoyed the maximum no. of days for development of plants. The maximum height as per (Table-1) was recorded under the variety HUW-234 followed by K-307, Mahi and PBW-343.Whereas the shortest plants were recorded in variety PBW-343 and slightly taller in Mahi. The tallest plants in variety HUW-234 may be attributed to the genetic character of the variety. Similar result is found in finding of Naik *et al.* (1991) [6].

The highest no of shoots /m^2 was observed under first dates of sowing of crops. It population increase found was seen in all dates of sowing till jointing stage but slight decrease in maturity of wheat was observed. In case of variety, the no. of shoots/m^2 was increased upto the jointing stage there after slight decreased up to maturity. The variety PBW-343 has the maximum no of shoots/m^2 followed by K-307, Mahi and HUW-343 in all the stages (Table-2). These observations are found similar to Shivani *et al.* (2001) and Keim *et al.* (2003).

Dry matter production was affected significantly by dates of sowing at all the stages of crop growth from CRI to maturity. By these observations, it is clear that maximum dry matter was produced by first date at all the stages followed by second, third and fourth date. The reason behind more dry matter in the first date followed by second third and fourth may be due to proper establishment of the crop plants, increased height, and larger vegetative growth. PBW-343 has registered a significant increase in dry matter over other three varieties K-307, Mahi & HUW-234 till the panicle stage (Table-2). Similar result was recorded in finding of Mishra *et al.* (2003) [5], Keim & Singh (2005) [4].

Yield and yield attributes

Difference in various yield contributing characters due to different varieties was highest mean number of spikelets/ear (16.75) under first date of sowing was noted significant as compared to second (16.25), third (15.17) and fourth (14.42) number of spikelets/ear respectively (Table-3). (Naik *et al.* (1991) [6].

The mean longest length (10.75 cm) was found significantly at first date of sown due to longed crop duration as compared to second (9.67 cm), third (8.92 cm) and fourth (7.42 cm) dates at harvest. Among the varieties, HUW-234 had longer ears (10.75 cm) as compared to the other three verities, but the interaction was not found significant. Table-3. Similar observation was found in finding of Tewari and Singh (1993) [11].

The grain weight/ear for the first date of sowing was found significantly maximum in comparison to other three dates D_2, D_3 and D_4, respectively. The maximum grain weight/ear under first date may be due to the reason that no. of grains/ear were higher in first date. The highest wt was recorded under variety PBW-343 (1.89g). Since no. of grains /ear were also higher in this variety, this must have contributed to more grain wt/ear also. The results are corroborated with the finding of Tewari and Singh (1993) [11] and Riaz *et al* (1998) [7].

Test weight of 1000 grain and number of grains/ear of wheat was influence due to varieties (Taable-3) significant higher test weight (1000 seed weight) and number of grains/ear of wheat were found in PBW-343 variety (36.67 g) fallowed by K-307 (34.83), Mahi and HUW-234 mainly due to bold seeded variety. Similar result were also reported highest test weight was found in PBW-343 mainly due to proportionatly higher increase in the seed weight over its density becouse of better partitioning of carbohydrate syntheses from source to sink. Results are similar with the result of Saxena *et al.* (1999) [8].

Grain yield of wheat was significant afftected due to varieties (Table-***3).***Significantly higher yield was recorded under the variety PBW-343, significant superior over K-307, Mahi and HUW 234 Since the grain wt/ear, test wt. and no. of grains/ear were maximum under the variety PBW-343, the ultimate result in yield is bound to increase. The most probable reason for these phenomena may be increased dry matter, more vegetative growth in PBW-343 than varieties K-307, Mahi HUW-234. Similar results observation recorded by Mudholkar (1981), Singh *et al.* (1984), Das & Gupta (1986) and Jam *et al.* (1992) [2].

Table 1: Effect of sowing dates and varieties on plant height (cm) at different growth stage of wheat

Treatment		Plant height (cm)			
Date of sowing	**Variety**	**CRI**	**PI**	**Anthesis**	**Maturity**
Nov., 30rt	PBW-343	7.9	73.3	86.7	90.7
	K-307	7.7	78.7	87.7	99.0
	Mahi	7.5	75.0	90.3	92.7
	HUW-234	7.3	79.0	92.7	97.0
Dec., 10	PBW-343	7.3	70.7	82.0	84.3
	K-307	6.9	75.3	94.7	95.0
	Mahi	6.6	71.0	84.7	87.0
	HUW-234	6.5	75.3	95.0	96.7
Dec., 20	PBW-343	6.4	62.0	79.3	80.0
	K-307	6.3	67.0	80.3	90.7
	Mahi	6.3	63.0	78.7	81.7
	HUW-234	6.2	69.0	80.3	92.3
Dec., 30	PBW-343	6.6	65.0	76.3	76.7
	K-307	6.4	63.7	79.3	90.0
	Mahi	6.2	58.3	77.3	78.0
	HUW-234	6.1	57.3	80.3	90.7
SEm ± (D X V)		0.020	0.180	0.243	0.347
CD 5%		0.049	0.449	0.606	0.865
November 30rt		7.61	76.50	89.33	94.83
December, 10th		6.80	73.08	89.08	90.75
December, 20th		6.32	65.25	79.67	86.17
December, 30rt		6.31	61.08	78.33	83.83
SEm ± (D)		0.068	0.373	0.505	0.373
CD 5%		0.144	0.811	1.097	0.857
PBW-343		7.04	67.75	81.08	82.92
K-307		6.80	71.17	85.50	93.67
Mahi		6.67	66.83	82.75	84.83
HUW-234		6.53	70.17	87.08	94.17
SEm ± (V)		0.062	0.370	0.500	0.474
CD 5%		0.132	0.804	1.087	1.090

Table 2: Effect of sowing dates and varieties on number of shoots/m^2 and Dry matter production (g/m^2) at different stages of wheat

Treatment		Number of shoots/m^2				Dry matter production (g/m^2)			
Date of sowing	**Variety**	**CRI**	**PI**	**Anthesis**	**Maturity**	**CRI**	**PI**	**Anthesis**	**Maturity**
Nov., 30rt	PBW-343	323.7	567.7	566.0	547.0	67.0	691.3	808.7	1411.3
	K-307	320.7	538.7	534.0	518.0	61.0	674.0	787.7	1379.3
	Mahi	314.0	530.3	527.0	515.7	58.3	660.7	781.7	1355.0
	HUW-234	308.0	501.7	498.7	588.3	57.0	657.7	777.7	1318.0
Dec., 10	PBW-343	310.3	524.0	520.0	511.3	60.0	670.3	782.3	1268.0
	K-307	308.7	490.3	490.3	568.7	57.7	664.3	769.0	1232.3
	Mahi	304.7	480.0	476.7	465.3	56.0	644.0	758.0	1212.0
	HUW-234	301.3	443.0	438.0	417.7	54.3	640.3	755.3	1197.0
Dec., 20	PBW-343	304.7	474.7	469.7	455.0	56.0	647.7	758.3	1223.7
	K-307	302.3	443.0	448.0	420.7	53.0	640.7	752.3	1174.7
	Mahi	302.0	414.7	411.0	401.7	52.7	637.0	730.0	1133.3
	HUW-234	298.3	403.3	398.3	385.7	49.7	635.0	725.0	1092.3
Dec., 30	PBW-343	300.7	402.0	391.3	382.0	54.7	636.3	729.0	1094.7
	K-307	298.3	381.7	378.7	371.0	50.7	629.7	727.7	1073.7
	Mahi	295.3	373.0	367.7	358.3	49.3	623.3	721.7	1043.0
	HUW-234	291.3	364.7	365.0	348.0	47.0	619.0	723.3	1032.0
SE ± (D X V)		0.362	0.333	0.458	0.412	0.281	0.274	0.195	0.371
CD 5%		0.902	0.831	1.142	1.029	0.700	0.684	0.488	0.926
November 30rt		316.6	534.6	531.4	542.3	60.8	670.9	788.92	1365.92
December, 10th		306.3	484.3	481.3	490.8	57.0	654.8	766.17	1227.33
December, 20th		301.8	433.9	431.8	415.8	52.8	640.1	741.42	1156.00
December, 30rt		296.4	380.3	375.7	364.8	50.4	627.1	725.42	1060.83
SE ± (D)		0.660	0.425	0.667	0.486	0.347	0.561	0.476	0.373
CD 5%		1.449	0.962	1.492	1.108	0.788	1.222	1.025	0.863
PBW-343		309.8	492.1	486.8	473.8	59.4	661.4	769.6	1249.4
K-307		307.5	463.4	462.8	469.9	55.6	652.2	759.2	1215.0
Mahi		304.0	449.5	445.6	435.3	54.1	641.1	747.8	1185.8
HUW-234		299.8	428.2	425.0	434.9	52.0	638.0	745.3	1159.8
SE ± (V)		0.676	0.497	0.737	0.589	0.411	0.558	0.456	0.492
CD 5%		1.485	1.124	1.649	1.344	0.934	1.215	0.983	1.138

Table 3: Influence of sowing dates and varieties on number of spiklets/ear, length of ear (cm), No. of grain/ear, grain weight/ear (g) and 1000-grain weight (g) and Seed yield (q/ha *(*of wheat

Date of sowing	Variety	No. of spike-lets/ear	Length of ear (cm)	Grain wt./ ear (g)	1000 grain wt.(g)	No. of grains /ear	Grain yield (q/ha)
Nov., 30rt	PBW-343	16.0	10.0	2.2	38.0	50.0	49.3
	K-307	17.0	11.7	1.9	37.0	49.0	46.3
	Mahi	16.0	9.3	1.8	36.3	47.0	42.0
	HUW-234	18.0	12.0	1.7	35.3	46.3	40.7
Dec., 10	PBW-343	15.3	9.0	1.9	36.7	45.3	44.3
	K-307	16.3	10.3	1.8	35.0	45.0	42.7
	Mahi	16.0	8.3	1.7	34.3	44.7	40.3
	HUW-234	17.3	11.0	1.6	33.3	43.7	37.0
Dec., 20	PBW-343	15.0	8.0	1.8	34.7	42.0	41.0
	K-307	15.7	9.7	1.7	34.3	43.0	37.0
	Mahi	14.0	8.0	1.6	33.0	42.3	33.3
	HUW-234	16.0	10.0	1.5	32.3	40.7	30.3
Dec., 30	PBW-343	13.3	7.0	1.7	34.7	39.3	37.3
	K-307	16.0	8.0	1.5	33.0	37.0	34.0
	Mahi	14.3	7.0	1.3	31.3	35.0	30.0
	HUW-234	14.0	7.7	1.1	29.7	34.3	28.0
SEm + (D X V)		0.215	0.118	0.002	0.266	0.310	0.132
CD 5%		0.537	0.294	0.005	0.663	0.773	0.329
November 30rt		16.75	10.75	1.90	36.67	48.08	44.58
December, 10th		16.25	9.67	1.75	34.83	44.67	41.08
December, 20th		15.17	8.92	1.64	33.58	42.00	35.42
December, 30rt		14.42	7.42	1.40	32.17	36.42	32.33
SEm+ (D)		0.531	0.312	0.006	0.461	0.304	0.385
CD 5%		1.143	0.668	0.012	1.017	0.706	0.821
PBW-343		14.92	8.50	1.89	36.00	44.17	43.00
K-307		16.25	9.92	1.70	34.83	43.50	40.00
Mahi		15.08	8.17	1.62	33.75	42.25	36.42
HUW-234		16.33	10.17	1.47	32.67	41.25	34.00
SEm + (V)		0.508	0.295	0.005	0.480	0.407	0.358
CD 5%		1.093	0.631	0.012	1.058	0.943	0.764

Conclusion

This experiment concluded that the varieties PWB-343 was superior to K-307, Mahi and HUW-234, respectively, from yield point of view and its attributes Regarding selection of varieties under four dates tested in the study was also very clear that sequence of varieties in order of preference was PWB-343, K-307, Mahi HUW-234.

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