Vol.12 No. 1, Page No. 73–84 (2023)

Received: February, 2023; Accepted: April, 2023

Performance of New Wheat (*Triticum aestivum* L.) Varieties at Different Dates of Sowing under Irrigated Conditions

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Abstract

The present Field experiment was conducted at Agricultural Research Farm of Raja Balwant Singh College, Bichpuri Agra, during Rabi season of 2020-21 to evaluate the "Performance of new wheat (Triticum aestivum L.) varieties at different dates of sowing under irrigated conditions" to fulfill the requirement of objectives of the investigation field experiment was conducted during Rabi season of 2020-21.. The Variables involved in this study were three dates of sowing D_1 (timely Nov. 5th), D_2 (late Dec. 12th) and D_3 (very late Jan. 5th) and five varieties of wheat JKW-261 (V_1), DBW-173 (V_2), WH-1124 (V_3), HD-3059 (V_4) and PBW-771 (V_5). Thus, in all 15 treatment combinations were compared in a "split plot design" having dates of sowing in main plots and varieties in sub plots with four replications. The soil of experimental field was sandy loam in texture with a pH 8.16. The soil was low in available nitrogen (181.50 Kg ha^{-1}), medium in available phosphorus (27.86 P_20_5 ha^{-1}) and potash (286.36 kg K_2O ha^{-1}). During Rabi reason of 2020-21, only 9.0 mm rainfall was received. Number of shoots metre^{-1} row length were significantly higher with timely (Nov. 5th) date of sowing over late (Dec. 12th) and very late (Jan. 5th) dates of sowing. Dry matter accumulation in plants of 25 cm row length in timely sown crop was to the tune of 2.29 and 6.56 per cent than late (12th Dec.) and very late (5th Jan.) dates of sowing, respectively. The Timely (5th Nov.) sown crop had significantly higher number of spikelets spike^{-1} by 2.96 and 24.85 per cent, respectively over late (12th Dec.) and very late (5th Jan.) sown crop. The 1000 grains weight reduced significantly from timely date of sowing to late and very late dates of sowing. Total biological, grain and straw yields were obtained significantly higher with timely date of sowing (Nov. 5th) over late (Dec. 10th) and very late (Jan. 1st) dates of sowing. The highest harvest index was recorded with timely date of sowing and it was significantly higher over late and very late date of sowing. Wheat crop sown timely on 5th Nov. gave higher net returns and B:C ratio over late and vary late sown crop. Germination count, Significantly, higher number of shoots metre^{-1} row length, higher dry matter accumulation in plant of 25 cm row length, taller plants, more days to 75 per cent spike emergence, more fertile spikelets spike^{-1} by 5.91 to 35.53 per cent, higher grain weight spike^{-1}, higher 1000 grain weight, higher biological yield by 3.60 to 14.99 per cent and higher grain yield (48.27 q ha^{-1}) was obtained with variety PBW-771 over all other varieties Highest net return of Rs. 82287.36 ha^{-1} and B:C ratio of 2.79 were obtained from the wheat variety PBW-771 sown timely on Nov. 5th.

Keywords : Dates of sowing, irrigated condition, wheat varieties.

Introduction

Wheat (*Triticum aestivum* L.) is considered as the second most significant cereal crop globally and nationally in India. It is estimated that over two thirds of the world's population feed on wheat due to its high protein and gluten rich content. During 2020-21 wheat was cultivated on an area of about 220.83 million hectares with a production of 775.71 million tonnes (USDA 2021). It is used as a staple food by 10 billion individuals over the entire world mainly in 43 countries and contributing 30% to overall grain demand of the world

standing at top in cereal crops. It gives around 20% of the aggregate food calories for mankind (Ali *et al.* 2018). Recent estimate indicated that world would need around 1090 million tonnes of wheat by 2050 from its current production level. To meet this demand, developing countries should increase their wheat production by 77% and more than 80% of demand should come from vertical expansion (Paroda *et al.,* 2013).

In India, Uttar Pradesh has the largest area 9.85 m ha under wheat cultivation and it is the highest producer 35.5 mt as well. The major area under wheat falls in the Indo-Gangetic Plains (IGP) which accounts for roughly 20 million hectares covering the states of Punjab, Haryana, Uttar Pradesh, Bihar and West Bengal. The states of Punjab and Haryana provide maximum contribution to the wheat buffer stock, an essential component of food security in our country (Agricultural Statistics at a Glance 2021). Global warming in recent decades is the main reason for the loss of yield of international cereal crops, which means that traditional cultivation methods need to be changed or modified (Kawa *et al.*, 2021). Sowing date was postulated as the main factor of higher cereal grain yield output without any extra economical inputs (Vieira *et al.*, 2019). Therefore, in view of the above consideration the present investigation was conducted to find out the suitable sowing date for different wheat varieties under irrigated conditions, to screen the best variety out of the varieties tested, to work out the economic feasibility of different treatments.

Material and Method

The present field experiment entitled "*Performance of new wheat (Triticum aestivum* L.*) varieties at different dates of sowing under irrigated conditions*" was conducted during *Rabi* season of 2020-2021 at Agricultural Research Farm, R.B.S. College, Bichpuri, Agra. The experimental crop of wheat crop was raised after Bajra in *Kharif* season at the Agricultural Research Farm, Raja Balwant Singh College, Bichpuri, Agra which is located at altitude of 27.20^0 North and longitude of 77.90^0 East with an elevation of 163.4 m above the mean sea level. The research farm is located at the distance of about 11 km to the west of Agra city on Agra-Bharatpur Road. This region falls under south-western semi-arid zone of Uttar Pradesh. The soil of experimental field was Gangetic alluvial with calcareous layer at the depth of about 1.5–2.0 meters and was well drained. To ascertain the fertility status and other physico-chemical properties of the soil of experimental area, a composite soil sample from the 0-30 cm. depth was taken just before sowing and was subjected to various mechanical and chemical analyses. To fulfill the requirement of objectives of the investigation field experiment was conducted during *Rabi* season of 2020-21. A "Split plot design" with three dates of sowing (main plot) and five wheat varieties (sub plot) replicated four times was adopted. Other details about treatments are given below:

(a) Dates of Sowing (main plots)		**Notations**
1. Timely (5^{th} Nov. 2020)	:	D_1

2. Late (10th Dec.2020) : D_2
3. Very Late (1th Jan. 2021) : D_3

(b) Wheat Varieties (sub plots)

1. JKW261 : V_1
2. DBW173 : V_2
3. WH1124 : V_3
4. HD3059 : V_4
5. PBW771 : V_5

Result and Discussion

Progressive data on growth and development characters of wheat in terms of crop stand, shoot height, dry matter accumulation in plants of 25 cm row length, days to 75 per cent spike emergence and days to physiological maturity of the crop as affected by dates of sowing and different varieties have been described below.

Germination count and crop stand

Germination count decreased significantly with every delay in the timely sowing date. Germination count was significantly higher with timely sowing date (D_1) by 3.14 and 15.41 per cent over late (10th Dec.) and very late (1st Jan), respectively. Late sowing date (D_2) also increased germination count appreciably than very late sowing (D_3) and the difference was 11.89 per cent.

Table 1 Germination count at 15 DAS and number of shoots metre^{-1} row length at successive stages of crop growth as influenced by dates of sowing and varieties.

Treatments		Germination Count	No. of shoots metre^{-1} row length				
		15 DAS	30 DAS	60 DAS	90 DAS	120 DAS	At harvest
Date of Sowing							
Timely (5th Nov.)	**D_1**	54.82	83.75	93.02	108.50	100.00	89.00
Late (10th Dec.)	**D_2**	53.15	80.75	90.57	98.95	92.25	80.58
Very late (1th Jan)	**D_3**	47.50	75.10	83.37	91.55	85.55	75.30
SEm ±		0.28	0.73	0.38	0.43	0.46	0.46
CD at 5%		1.11	2.88	1.50	1.70	1.82	1.82
Varieties							
JKW261	**V_1**	52.96	81.38	90.75	100.58	93.33	83.00
DBW173	**V_2**	50.38	78.50	86.96	98.33	91.00	79.83
WH1124	**V_3**	50.38	78.54	87.92	98.88	91.83	79.96
HD3059	**V_4**	51.83	79.50	87.08	99.21	92.17	81.21
PBW771	**V_5**	53.58	81.42	92.25	101.37	94.67	84.13
SEm ±		0.53	0.67	0.71	0.54	0.53	0.66
CD at 5%		1.26	1.60	1.71	1.29	1.26	1.57

Variety PBW771 (V_5) differed marginally with JKW261 (V_1) had significantly higher germination count over rest of the varieties. Variety PBW771 (V_5) did not differ much with variety JKW261 (V_1) and both the varieties were significantly superior over rest of the varieties under test at all the stages of crop growth with respect to number of shoots metre^{-1} row length. At harvest, the magnitude of increase in number of shoots metre^{-1} row length with PBW771 (V_5) was to the tune of 5.39, 5.22 and 3.60 per cent, over DBW173 (V_2), WH1124 (V_3) and HD3059 (V_4), respectively.

Shoot Height (cm)

The shoot height significantly reduced with every delay in date of sowing, thus, the minimum shoot height was recorded with 1st Jan. date of sowing (D_3). At harvest, the reduction in shoot height with late (10th Dec.) and very late (1st Jan.) sowing date was to the tune of 2.45 and 3.49 per cent, respectively when compared with timely sowing date (5th Nov.).

Variety PBW771 (V_5) produced significantly longer shoots over all other variety except JKW261 (V_1) at all the stages of crop growth. At harvest, the increase in shoot height with Variety PBW771 (V_5) was to the tune of 4.21, 2.11and 1.78 per cent, respectively over DBW173 (V_2), WH1124 (V_3) and HD3059 (V_4) Varieties.

Dry matter accumulation in plants of 25 cm row length

The dry matter accumulation in plants of 25 cm row length was significantly reduced with every delay in sowing, thus, the minimum dry matter accumulation in plants was recorded with very late sowing (1st Jan.). At harvest, the magnitude of reduction in dry matter accumulation in plants of 25 cm row length was to the tune of 2.29 and 6.56 per cent due to late (10th Dec.) and very late (1st Jan.) dates of sowing, respectively when compared with timely sowing (5th Nov.).

Variety PBW771 (V_5) produced significantly higher dry matter over all other varieties at all the stages of crop growth and at harvest. The magnitude of increase in dry matter accumulation in plants of 25 cm row length with variety PBW771 (V_5) at harvest was to the tune of 2.41 to 5.01 per cent variety JKW261 (V_1) also had significantly higher dry matter accumulation in plants of 25 cm row length than rest of the varieties at all the stages of crop growth and at harvest; the magnitude of increase was to the tune of 4.60, 3.29 and 2.55 per cent over DBW173 (V_2), WH1124 (V_3), and HD3059 (V_4), respectively.

Yield Studies

Yield Attributes

In case of wheat the main yield contributing characters are stand count m^{-2}, spike m^{-2}, number of grains spike^{-1}, length of spike, number of spikelets spike^{-1}, number of fertile spikelets spike^{-1}, weight of grains spike^{-1} and 1000-grain weight.

Stand count m^{-2}

The stand count metre^{-2} decreased significantly with every delay in the sowing date from timely sowing. The decrease in stand count metre^{-2} with late

sowing at 10th Dec. (D_2) and very late sowing at 1st Jan. (D_3) was 1.30 and 6.29 per cent, respectively than that of timely sowing (D_1).

Variety JKW261 (V_1) also registered significantly higher stand count meter^{-2} over rest of the varieties. The magnitude of increase in stand count meter^{-2} with PBW771 (V_5) and JKW261 (V_1) was to the tune of 1.68 to 7.00 per cent and 1.14 to 5.23 per cent, respectively over rest of the Varieties.

Table 2 Shoot height (cm) at successive stages of crop growth as influenced by Date of Sowing and varieties

Treatments		Shoot height (cm)				
		30 DAS	60 DAS	90 DAS	120 DAS	At harvest
Date of Sowing						
Timely (5th Nov.)	**D_1**	4.28	22.50	44.92	88.28	88.93
Late (12th Dec.)	**D_2**	3.78	20.61	43.43	86.57	86.80
Very late (5th Jan)	**D_3**	3.55	22.35	41.74	85.50	85.93
SEm ±		0.10	0.11	0.15	0.34	0.16
CD at 5%		0.39	0.44	0.61	1.34	0.63
Varieties						
JKW261	**V_1**	3.91	21.83	43.99	87.93	88.49
DBW173	**V_2**	3.70	21.15	42.54	84.88	85.06
WH1124	**V_3**	3.89	21.41	42.56	86.35	86.81
HD3059	**V_4**	3.89	21.55	43.22	86.63	87.09
PBW771	**V_5**	3.95	23.14	44.50	88.12	88.64
SEm ±		0.08	0.07	0.19	0.35	0.42
CD at 5%		NS	0.17	0.45	0.83	0.99

Table 3 Dry matter accumulation in plant of 25 cm row length at successive stages of crop growth as influenced by various treatments.

Treatments		Dry matter accumulation (g)				
		30 DAS	60 DAS	90 DAS	120 DAS	At harvest
Date of Sowing						
Timely (5th Nov.)	**D_1**	7.01	15.74	50.78	127.27	134.72
Late (12th Dec.)	**D_2**	6.29	14.87	53.31	125.63	131.71
Very late (5th Jan)	**D_3**	5.75	13.42	50.61	121.64	126.43
SEm ±		0.13	0.22	0.55	0.42	0.67
CD at 5%		0.52	1.22	2.16	1.62	2.64

Varieties						
JKW261	V_1	6.47	14.85	52.44	125.48	131.50
DBW173(C)	V_2	5.65	14.01	49.22	123.17	128.08
WH1124(C)	V_3	6.07	14.31	49.25	123.75	129.69
HD3059(C)	V_4	6.42	14.68	50.96	124.32	131.34
PBW771 (C)	V_5	7.13	15.53	55.96	128.03	134.13
SEm ±		0.17	0.25	1.56	1.05	1.14
CD at 5%		0.40	0.59	3.72	2.52	2.73

Number of Spikes m^{-2}

The magnitude of increase in the number of spike $meter^{-2}$ with timely sowing date (D_1) was to the tune of 1.32 and 6.71 per cent respectively over late (D_2) and very late (D_3) dates of sowing. Variety JKW261 (V_1) also significantly produced a greater number of spikes $meter^{-2}$. The magnitude of increase in the number of spikes $meter^{-2}$ with variety PBW771 (V_5) and JKW261 (V_1) was 1.69 to 3.34 per cent and 1.02 to 2.65 per cent, respectively. The minimum number of spikes $meter^{-2}$ (228.71) was recorded with variety DBW173 (V_2) which was significantly inferior to all other varieties.

Length of Spike (cm)

Length of spike significantly reduced with every delay in sowing date, thus, lowest spike length was recorded with very late date of sowing (1st Jan.). The magnitude of reduction in spike length with late (10th Dec.) and very late (1st Jan.) dates of sowing was to the tune of 7.42 and 26.62 per cent, respectively when compared with timely sowing (5th Nov.).

Variety PBW771 (V_5) and JKW261 (V_1) differed marginally produced significantly longer spikes over rest of the varieties tested in this experiment. The magnitude of increase in length of spike with variety PBW771 (V_5) and JKW261 (V_1) was to the tune of 9.46 to 36.73 and 5.57 to 31.88 per cent, respectively over rest of the Significantly shortest spikes were noted with variety DBW173 (V_2).

No. of grains $spike^{-1}$

The number of grains $spike^{-1}$ significantly reduced with every delay in date of sowing. The magnitude of reduction in the number of grains $spike^{-1}$ was to the tune of 8.09 and 16.61 per cent with late (Dec. 10th) and very late (Jan. 1st) dates of sowing as compared to timely sowing (Nov.5th). Late (Dec.10th) date of sowing was also significantly superior with very late (Jan.1st) date of sowing in this respect.

Variety PBW771 (V_5) produced significantly higher number of grains $spike^{-1}$ (54.67) over all other varieties and the magnitude of difference was 4.35 to 16.07. The second best variety in this respect was JKW261 (V_1) gave appreciably 3.91 to 11.23 per cent higher number of grains $spike^{-1}$ than rest of the

varieties. The minimum number grains spike^{-1} (47.10) was noticed with DBW173 (V_2) which was significantly lower than all other varieties except WH1124 (V_3).

Weight of grains spike^{-1}

The maximum weight of grains spike^{-1} was recorded with timely date of sowing (5th Nov.) which was significantly superior over late (10th Dec.) and very late (1st Jan.) dates of sowing and the increase was to the tune of 12.56 and 37.87 per cent, respectively.

The Table 4 further shows that variety PBW771 (V_5), had significantly higher grain weight spike^{-1} (2.44 g) over all other varieties. The magnitude of increase in weight of grains spike^{-1} with variety V_5 was to the tune of 15.09, 38.64, 31.18 and 23.86 per cent than V_1, V_2, V_3 and V_4, respectively.

1000-Grain Weight

The 1000-grain weight reduced significantly with every delay in sowing as compared to timely sowing. 1000 grain weight appreciably reduced to late (Dec. 10th), very late (Jan. 1st) dates of sowing by 29 and 12.90 percent respectively as compared to timely sowing (5th Nov.).

The data summarized in Table 4 reveal that variety PBW771 (V_5) produced significantly higher 1000- grain weight (44.64 g) when compared with all other varieties and the difference was 10.22 to 19.74 per cent.

Table 4 Yield attributes of wheat as influenced by date of sowing and varieties

Treatments		Stand Count m^{-2}	No. of spikes m^{-2}	Length of Spike (cm)	No. of Spikelets spike^{-1}	No. of Fertile Spikelets spike^{-1}	No. of grains spike^{-1}	Weight of grains spike^{-1}(g)	1000 grain weight (g)
Date of Sowing									
Timely (5thNov.)	**D_1**	253.20	236.73	8.49	60.54	59.52	55.15	2.33	42.26
Late (12th Dec.)	**D_2**	249.90	234.77	7.86	58.80	56.04	50.69	2.07	40.87
Very late (5thJan)	**D_3**	237.27	226.65	6.23	48.49	42.96	45.99	1.69	36.81
SEm ±		0.43	0.38	0.15	0.43	0.60	0.51	0.06	0.30
CD at 5%		1.69	1.50	0.58	1.68	2.36	1.66	0.22	1.18
Varieties									
JKW261	**V_1**	250.04	234.78	8.15	60.83	57.05	52.39	2.12	40.50
DBW173	**V_2**	237.62	228.71	6.18	46.85	44.58	47.10	1.76	37.28
WH1124	**V_3**	244.83	231.33	7.16	51.50	49.00	48.47	1.86	38.39
HD3059	**V_4**	247.22	232.42	7.72	56.08	53.17	50.42	1.97	39.11
PBW771	**V_5**	254.25	236.35	8.45	64.43	60.42	54.67	2.44	44.64
SEm ±		0.67	0.60	0.30	1.20	1.33	0.65	0.10	0.55
CD at 5%		1.60	1.43	0.72	2.86	3.17	1.55	0.24	1.32

Effect of dates of sowing Yield (q ha^{-1}) Biological Yield (q ha^{-1})

Maximum biological yield was recorded with timely sowing date (5th Nov.) which was significantly superior over late (10th Dec.) and very late (1st Jan.) dates of sowing. Late sowing (Dec. 10th) also gave significantly higher biological yield than very late (Jan 1st) date of sowing. The magnitude of increase in biological yield in timely sowing was to the tune of 7.44 and 17.33

per cent over late and very late date of sowing, respectively.

The data presented in Table-5 indicate that variety PBW771 (V_5) produced significantly higher biological yield over all other varieties and the variation was 3.60 to 14.99 per cent. Variety JKW261 (V_1) also gave significantly higher biological yield than that of DBW173 (V_2), WH1124 (V_3) and HD3059 (V_4) by 10.99, 5.06 and 2.36 per cent respectively.

Grain Yield (q ha^{-1})

Timely sowing date (5th Nov.) resulted in significantly higher grain yield as compared to late (10th Dec.) and very late (1st Jan.) dates of sowing. Late sowing (10th Dec.) also had significantly higher grain yield than very late (1st Jan.) date of sowing. The difference in grain yield of wheat due to timely sowing was 11.73 and 25.10 per cent higher over late and very late sowing, respectively.

The data presented in Table 5 revealed that variety PBW771 (V_5) had significantly more grain yield (48.27 q ha^{-1}) as compared to all other varieties and the magnitude of increase was 5.58 to 23.17 per cent. Variety JKW261 (V_1) also gave significantly higher grain yield by 4.62 to 16.66 per cent over rest of the varieties.

Table5 Biological, Grain and Straw yield of wheat as influenced by various treatments.

Treatments		Biological yield (q ha^{-1})	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})	Harvest index (%)
Date of Sowing					
Timely (5thNov.)	**D_1**	119.83	49.89	69.94	41.63
Late (12th Dec.)	**D_2**	110.92	44.04	66.88	39.70
Very late (5thJan)	**D_3**	99.06	37.37	61.69	37.72
SEm ±		0.43	0.56	0.27	0.14
CD at 5%		1.69	2.22	1.08	0.55
Varieties					
JKW261	**V_1**	112.97	45.72	67.25	40.47
DBW173	**V_2**	101.78	39.19	62.59	38.50
WH1124	**V_3**	107.53	41.95	65.58	39.01
HD3059	**V_4**	110.37	43.70	66.67	39.59
PBW771	**V_5**	117.04	48.27	68.77	41.24
SEm ±		1.07	1.03	0.73	0.51
CD at 5%		2.56	2.45	1.73	1.23

Straw Yield (q ha^{-1})

The maximum straw yield was recorded with timely sowing (5th Nov.) significantly higher than late and very late date of sowing and the magnitude of difference was 4.38 and 11.80 per cent, respectively.

Variety PBW771 (V_5) had significantly higher straw yield as compared to all other varieties except JKW261 (V_1) and the magnitude of increase was 3.15 to 9.87 per cent. The lowest straw yield was recorded with

variety DBW173 (V_2) which was significantly inferior to all other varieties.

Harvest Index

Different dates of sowing had significant effect on harvest index (Table5). The highest harvest index (41.63%) was recorded with timely sowing (5th Nov.) which was significantly higher by 4.64 and 9.39 per cent than late (10th Dec.) and very late (1st Jan.) dates of sowing. Very late sowing proved its significant inferiority in this respect.

The variation in harvest index due to varieties JKW261 (V_1) and PBW771 (V_5) was marginal and could not cross the level of significance but both the varieties had significantly higher harvest index over variety (V_2), WH1124 (V_3) and HD3059 (V_4) which were statistically at par among themselves.

Economic analysis of Wheat

The Table under reference showed that the highest net return of Rs. 82287.36 ha^{-1} and B:C ratio of 2.79 was recorded with when variety PBW771 (V_5) sown timely on Nov. 5th. With this sowing date, the net return and B:C ratio with variety JKW261 (V_1) was Rs 79427.24 and 2.73, respectively. The additional net profit Rs. 2860 to Rs. 24577 was obtained by g PBW771 (V_5) while sown timely on 5th Nov. as compared to all other treatment combinations.

Table 6 Economics of wheat crop (Rs. ha^{-1}) as influenced by dates of sowing and varieties

Treatments	Gross return (Rs. ha^{-1})	Cost of cultivation (Rs. ha^{-1})	Net return (Rs. ha^{-1})	B:C ratio
D_1V_1	125282.6	45855	79427.24	2.73
D_1V_2	117785.8	45855	71930.36	2.57
D_1V_3	121184.0	45855	75328.61	2.64
D_1V_4	123157.4	45855	77301.99	2.69
D_1V_5	128142.8	45855	82287.36	2.79
D_2V_1	118817.3	45855	72961.86	2.59
D_2V_2	111320.4	45855	65464.99	2.43
D_2V_3	114718.6	45855	68863.24	2.50
D_2V_4	116692.0	45855	70836.61	2.54
D_2V_5	121677.4	45855	75821.99	2.65
D_3V_1	111062.9	45855	65207.49	2.42
D_3V_2	103566.0	45855	57710.61	2.26
D_3V_3	106964.3	45855	61108.86	2.33
D_3V_4	108937.6	45855	63082.24	2.38
D_3V_5	113923.0	45855	68067.61	2.48

Result and Discussion

Dates of sowing had significant effect on germination count which was significantly higher with timely sown crop. Number of shoots $metre^{-1}$ row length were significantly higher with timely (Nov. 5th) date of sowing over late (Dec. 12th) and very late (Jan. 5th) dates of sowing. The plant height significantly reduced with every delay in sowing from timely to late and very late dates of sowing. The dry matter accumulations in 25 cm row length were significantly reduced with every delay in sowing. At harvest, the magnitude of increase in dry

matter accumulation in plants of 25 cm row length in timely sown crop was to the tune of 2.29 and 6.56 per cent than late (12th Dec.) and very late (5th Jan.) dates of sowing, respectively. Late and very late dates of sowing required significantly less days to 75 per cent spike emergence and maturity as compared to timely date of sowing. Length of spike was significantly reduced with late and very late date of sowing over timely date of sowing.

The Timely (5th Nov.) sown crop had significantly higher number of spikelets spike^{-1} by 2.96 and 24.85 per cent, respectively over late (12th Dec.) and very late (5th Jan.) sown crop. Number of fertile spikelets spike^{-1} was significantly higher due to timely date of sowing (5th Nov.) by 6.23 and 38.55 per cent, respectively over late (12th Dec.) and very late (5th Jan.) dates of sowing. Weight of grains spike^{-1} were significantly higher with timely date of sowing as compared to late and very late dates of sowing and the increase was to the tune of 12.56 and 37.87 per cent, respectively. The 1000 grains weight reduced significantly from timely date of sowing to late and very late dates of sowing. Total biological, grain and straw yields were obtained significantly higher with timely date of sowing (Nov. 5th) over late (Dec. 10th) and very late (Jan. 1st) dates of sowing. The highest harvest index was recorded with timely date of sowing and it was significantly higher over late and very late date of sowing. Wheat crop sown timely on 5th Nov. gave higher net returns and B:C ratio over late and vary late sown crop.

Germination count affected significantly due to varieties at 15 DAS and it was appreciably higher with variety PBW-771. Significantly higher number of shoots metre^{-1} row length was recorded with variety PBW-771 over all other varieties at all the stages of crop growth except JKW261 and at harvest the difference was 3.60 to 5.39 per cent. Variety PBW-771 produced significantly taller plants over rest of the varieties at all the stages of crop growth except 30 DAS. Variety PBW-771 gave significantly higher dry matter accumulation in plant of 25 cm row length than all other varieties at all stages of crop growth and at harvest. Variety PBW-771 took significantly more days to 75 per cent spike emergence and maturity over all other varieties. Variety PBW-771 had significantly longer spike by 9.46 to 36.73 per cent than all other varieties except JKW-261. Variety PBW-771 recorded significantly more fertile spikelets spike^{-1} by 5.91 to 35.53 per cent than rest of the varieties. Varieties PBW-771 had significantly higher grain weight spike^{-1} over rest of the varieties. Significantly higher 1000 grain weight was obtained with variety PBW-771 which was 10.22 to 19.74 per cent as compared to all other varieties. Variety PBW-771 produced significantly higher biological yield by 3.60 to 14.99 per cent over all other varieties.

Significantly higher grain yield 48.27qha^{-1} was obtained with variety PBW-771 over all other varieties and the magnitude of increase was 4.62 to 16.66 per cent. The second-best variety in this respect was JKW-261.Variety PBW-771 was at par with JKW261, gave significantly higher straw yield over rest of the varieties. Variation in harvest index with varieties PBW-771 and JKW261 was not well mark but both the varieties had significantly higher harvest index over rest of the varieties. Highest net return of Rs. 82287.36 ha^{-1} and B:C

ratio of 2.79 were obtained from the wheat variety PBW-771 sown timely on Nov. 5th.

Conclusion

Timely sowing date (Nov. 5th) was found best for different varieties of wheat under irrigated conditions. Among the wheat varieties tested, PBW-771 gave better results followed by JKW261 in respect of grain and straw yield. On the basis of maximum net return and B:C ratio wheat variety PBW-771 sown on Nov. 5th may be recommended for irrigated conditions.

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