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Physiological evaluation of wheat genotypes under normal irrigated and non-irrigated conditions

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Abstract
The present inves Stigation entitled as "Physiological evaluation of wheat genotype under normal irrigated and non-irrigated conditions" was carried out in *rabi* season of 2017-18 at Wheat Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (M.S.). It is carried out under two sowing environment i.e. normal irrigated and non-irrigated condition and 25 wheat genotypes viz., HD 3237, DBW 166, JWS 810, RIL-S1-126, DBW 110, DBW 93, WH 1235, MP 3288, GW 477, NIAW 3170, K 1317, DBW 136, HI 1620, M 516, DBW 252, NI 5439, RIL-S1-38, MACS 6696, RW 5, NIAW 3212, BRW 3806, C 306, MACS 6695, HI 1628, MP 133 were tested. The experiment was laid out in Simple lattice design with two replications.

Different yield and physiological traits viz. germination, days to heading, days to anthesis, days to maturity, plant height, number of productive tillers at maturity, number of grains per spike, grain weight/ spike, 1000 grain weight, biological yield, grain yield, harvest index, chlorophyll content index (at 15 and 21 days after anthesis), canopy temperature (at 15 and 21 days after anthesis) may be used in research programme for development of moisture tolerant genotypes for changing climatic scenario.

The growth, yield attributes and physiological attributes showed significant increase when wheat crop was sown under normal irrigated condition. Grain yield obtained was significantly higher in sowing under irrigated condition. Wheat crop sown at irrigated condition showed lowest canopy temperature (at 15 and 21 days after anthesis) as compare to sown under non-irrigated condition. Sowing of wheat crop under irrigated condition was found to be most economical.

Out of 25 genotypes tested under experiment, genotype GW 477 was superior over other in respect of number of productive tillers, number of grains per spike, grain weight/ spike, grain yield, harvest index as compare to other genotypes under normal irrigated condition. In non-irrigated condition, MACS 6696 superior in respect of grain yield, harvest index and chlorophyll content index at 21 days after anthesis

Keywords: Physiological evaluation, normal irrigated and non-irrigated conditions

Introduction
Wheat is grown in all the states in India except Southern and North Eastern states. Uttar Pradesh, Haryana, Punjab, Rajasthan are the major wheat producing states and accounts for almost 80% of total production in India. Only 13% area is rainfed, Major rainfed wheat area found in Madhya Pradesh, Gujarat, Maharashtra, West Bengal and Karnataka. Central and Peninsular Zone accounts total 1/3rd of wheat area in India. On all India basis, only 1/3 irrigated wheat receives desired irrigations and remaining is limited irrigation only. Breeding programmes are generally aimed for rainfed and irrigated environments and there is need to develop varieties which are responsive to limited irrigation conditions. Thus, to increase the productivity of this region different physiological technique need to be adopted for improving water use efficiency and breeding wheat genotypes tolerant to water stress.

Material and methods
The present investigation entitled that, "Physiological evaluation of wheat genotypes under normal irrigated and non-irrigated condition" laid out in simple lattice design with full irrigated and non-irrigated environments as a 5 block and 25 genotypes.

Treatment details.

Replication 1					
Block 1	HD 3237	DBW 166	JWS 810	RIL-S1-126	DBW 110
Block 2	DBW 93	WH 1235	MP 3288	GW 477	NIAW 3170
Block 3	K 1317	DBW 136	HI 1620	M 516	DBW 252
Block 4	NI 5439	RIL-S1-38	MACS 6696	RW 5	NIAW 3212
Block 5	BRW 3806	C 306	MACS 6695	HI 1628	MP 1331
Replication 2					
Block 1	M 516	MP 3288	C 306	DBW 110	NI 5439
Block 2	MP 1331	RIL-S1-126	DBW 93	RIL-S1-38	HI 1620
Block 3	MACS 6696	BRW 3806	DBW 252	GW 477	DBW 166
Block 4	HD 3237	DBW 136	RW 5	MACS 6695	NIAW 3170
Block 5	BRW 3806	C 306	MACS 6695	HI 1628	MP 1331

Results and discussion

The results obtained are discussed to have a clear understanding about the relationship of different factors *viz.* irrigated and non-irrigated condition on morphological and physiological characters of wheat genotypes.

1. Yield parameters

1.1 Germination (%) after two weeks of sowing.

Numerically out of 25 genotypes only one genotype K 1317 (98.61%) recorded statistical significance over other genotypes and remaining all genotype at *par* with general mean and with each other however under non-irrigated condition all genotypes at *par* with general mean and with each other for germination. Highest germination (%) was recorded in genotype NIAW 3170 (95.03%) under non-irrigated condition.

Table 1: Mean performance of different genotypes under normal irrigated and non-irrigated condition for germination (%) and days to heading (75%).

Treatment	Germination %		Days to heading (75%)	
	Normal irrigated	Non-irrigated	Normal irrigated	Non-irrigated
BRW 3806	93.32	92.51	67.58	69.53
DBW 110	93.37	85.08	68.01	67.39
DBW 136	88.98	90.01	68.82	60.89*
DBW 166	90.94	84.98	69.01	63.93*
DBW 252	92.91	82.61	68.32	66.35
GW 477	89.8	87.56	64.99	64.74
HD 3237	90.07	87.6	66.32	64.08
HI 1620	91.14	84.48	64.23	64.64
HI 1628	88.59	87.52	66.32	65.95
JWS 810	95.61	91.44	62.42	64.17
M 516	88.37	85.15	67.88	65.46
MACS 6695	92.86	87.35	66.68	62.62*
MACS 6696	96.03	82.34	59.61*	67.45
MP 1331	93.13	84.98	65.26	61.84*
NIAW 3170	94.34	95.03	67.43	62.14*
NIAW 3212	89.8	84.97	67.69	64.66
RIL-S1-126	90.34	90.11	65.07	68.5
RIL-S1-38	88.37	87.37	67.19	68.2
RW 5	86.76	82.51	60.25*	60.27*
WH 1235	90.4	89.93	64.93	64.67
DBW 93(C)	97.53	87.56	69.25	70.83
MP 3288(C)	96.57	89.90	68.35	64.42
K 1317(C)	98.61	80.14	69.63	67.54
NI 5439(C)	96.99	92.50	68.51	64.85
C 306(C)	95.69	93.38	68.76	67.87
GM	92.42	87.48	66.50	65.32
SE (m) ±	1.96	3.85	1.88	2.44
CD at 5%	5.49	10.79	5.27	6.85
"F" test	SIG	SIG	SIG	SIG

***-** Level of significance at 5%

1.2 Days to heading (75%).

Data indicated that some cultivars headed earlier than others which were in conformity with the findings of Rafiullah *et al*. (2007). Among the genotypes significant variations was observed under irrigated condition in days to 75% heading. Significantly minimum days recorded for 75% heading was observed in two genotypes over check *viz.* MACS 6696 (59.61) and RW 5 (60.25) However, under non-irrigated condition six genotypes shows statistical significance over check for days to early heading. Significantly minimum days were recorded for 75% heading was observed in *viz.* RW 5 (60.27), DBW 136 (60.89) and NIAW 3170 (62.14) respectively.

1.3 Days to maturity (75%).

Under normal irrigated condition, five genotypes recorded significantly minimum days to maturity over check. Early days to 75% maturity were recorded by genotypes MACS 6696 (109.02), RW 5 (110.82) and MACS 6695 (112.38). However under non-irrigated condition, four genotypes recorded statistical significance over check C 306 for days to 75% maturity. Genotype DBW 110 recorded lowest days to

75% maturity followed by genotypes NIAW 3170 (110.59) and HD 3237 (110.91) under non-irrigated condition. High moisture stress induced by rainfed sowing caused reduction by 1 day for days to maturity as compared to irrigated condition. Similar results were reported by Mekkei *et al.* (2014) [7], Ngwako and Mashiqa (2013) [9].

4.1.4 Number of productive tillers per meter row length.

Data presented in Table 4.2 indicated that, significant differences in respect to no. of effective tillers per meter at maturity. High moisture stress induced by sowing under non-irrigated condition (rainfed) condition (39.90) significantly decreased number of effective tillers per meter at maturity as compared to sown under irrigated

Table 2: Mean performance of different genotypes under normal irrigated and non-irrigated condition for days to maturity (75%) and productive tillers/ meter row.

Treatment	Days to maturity (75%)		Productive tillers/ meter row	
	Normal irrigated	Non-irrigated	Normal irrigated	Non-irrigated
BRW 3806	114.97	118.91	63.41	38.43
DBW 110	118.42	116.76	62.45	39.15
DBW 136	117.56	110.5*	61.74	36.67
DBW 166	119.89	113.86	61.85	38.83
DBW 252	118.59	116.4	61.84	37.50
GW 477	114.53	113.9	73.84*	38.3
HD 3237	117.03	110.91*	63.54	39.33
HI 1620	112.61*	114.24	62.69	37.98
HI 1628	117.18	115.56	61.15	38.96
JWS 810	118.94	114.1	72.30*	40.13
M 516	118.91	115.7	60.68	40.70
MACS 6695	112.38*	112.1*	62.16	36.24
MACS 6696	109.02*	116.94	65.57	37.44
MP 1331	116.36	117.26	62.81	41.26
NIAW 3170	117.71	110.59*	73.00*	41.61
NIAW 3212	118	114.09	62.72	39.96
RIL-S1-126	115.74	117.06	63.28	39.35
RIL-S1-38	117.97	118.2	61.62	44.13
RW 5	110.82*	114.4	61.55	36.65
WH 1235	113.18*	113.2	62.90	42.28
DBW 93(C)	119.32	119.74	75.60	39.28
MP 3288(C)	116.73	113.44	76.85	43.59
K 1317(C)	119.2	116.55	74.93	38.67
NI 5439(C)	115.11	115.24	68.81	43.63
C 306(C)	119.83	119.86	74.22	47.43
GM	116.4	115.18	66.06	39.90
SE (m) ±	2.28	2.41	0.91	2.41
CD at 5%	6.41	6.76	2.56	6.75
"F" test	SIG	SIG	SIG	SIG

***-** Level of significance at 5%

condition (66.06) in wheat crop. Similar results were reported by Mekkei *et al.* (2014) [7].

1.5 Plant height (cm).

Data on plant height (cm) was recorded at harvest presented in table 4.3. From data it was observed that, plant height progressively increase in different genotypes. It indicated that there was significant difference in plant height.

Data pertaining to plant height at harvest revealed that, among the 25 wheat genotypes, eight genotypes shows statistical significance over check. DBW 166 recorded significantly lowest plant height (80.96 cm) at harvest and followed by DBW 136 (80.99 cm) and MP 1331(80.99 cm). Under non-irrigated condition, 17 genotypes recorded significantly lowest plant height at harvest. Genotype GW 477 showed significantly lowest plant height (43.12 cm) at harvest followed by DBW 252 (45.59 cm) and MACS 6696 (46.5 cm). Genotype C 306 recorded highest plant height under both irrigated and non-irrigated condition.

1.6 1000 grain weight (g).

Table 3: Mean performance of different genotypes under normal irrigated and non-irrigated condition for plant height (cm) and 1000 grain weight.

Treatment	Plant height (cm)		1000 grain weight	
	Normal irrigated	Non-irrigated	Normal irrigated	Non-irrigated
BRW 3806	86.00	58.46*	52.59*	41.29*
DBW 110	83.97	66.58	47.13	30.79
DBW 136	80.99*	59.74*	45.77	33.03
DBW 166	80.96*	52.24*	49.1	23.04
DBW 252	93.00	45.59*	43.9	29.62
GW 477	86.00	43.21*	50.08*	38.44*

HD 3237	84.97	56.85*	47.33	27.28
HI 1620	81.05*	55.93*	54.19*	41.80*
HI 1628	88.01	64.24	46.46	34
JWS 810	86.52	56.93*	46.65	25.8
M 516	83.01*	59.64*	41.91	32.67
MACS 6695	83.55*	56.54*	52.53*	29.81
MACS 6696	84.54	46.5*	46.46	31.5
MP 1331	80.99*	59.7*	48.86	37.98
NIAW 3170	87.99	63.67	39.58	40.00*
NIAW 3212	81.99*	55.66*	51.22*	33.23
RIL-S1-126	89.48	52.13*	47.36	25.24
RIL-S1-38	81.98*	59.81*	52.89*	31.62
RW 5	83	54.2*	49.67	35.09
WH 1235	82.48	58.32*	47.88	29.73
DBW 93(C)	80.99	43.93	52.60	34.27
MP 3288(C)	86.54	57.51	47.17	38.75
K 1317(C)	90.01	59.35	53.97	41.26
NI 5439(C)	86.99	70.42	52.57	31.13
C 306(C)	111.98	81.35	54.17	40.28
GM	85.88	57.54	48.88	33.51
SE (m) ±	2.26	7.23	0.91	2.51
CD at 5%	6.35	20.29	2.56	7.03
"F" test	SIG	SIG	SIG	SIG

***-** Level of significance at 5%

Under non-irrigated condition, four genotypes shows statistical significance over check. Genotype HI 1620 (41.80 g) recorded highest 1000 grain weight and followed BRW 3806 (41.30 g), NIAW 3170 (40 g) and GW 477 (38.44 g). Lowest 1000 grain weight was recorded in DBW 166 (23.04 g).

1.7 Number of grains spike^{-1}.

Data pertaining to number of grains spike^{-1} were presented in table 4.4 indicated that, number of grains spike^{-1} were reduced under non-irrigated condition (rainfed) condition (27.32) as compared to normal irrigated condition (43.98).It might be due to favourable moisture regime helped in proper growth and development of crop that reflected in higher number of grains per spike. Similar results were reported by Khan *et al*. (2007), Akbari *et al*. (2011) [1].

Table 4: Mean performance of different genotypes under normal irrigated and non-irrigated condition for Number of grains/ spike and grain weight/ spike

Treatment	No. of grains/ spike		Grain weight/ spike	
	Normal irrigated	Non-irrigated	Normal irrigated	Non-irrigated
BRW 3806	43.67	33.50*	3.55	1.45
DBW 110	43.41	26.39	3.28	1.65
DBW 136	53.44*	25.69	3.09	1.80
DBW 166	46.08*	29.99	3.15	0.70
DBW 252	55.27*	28.1	2.91	1.50
GW 477	54.71*	24.47	3.86*	1.35
HD 3237	50.85*	23.42	3.15	0.95
HI 1620	46.59*	30.18	3.87*	1.10
HI 1628	39.44	28.47	3.38	1.15
JWS 810	39.23	24.47	2.85	0.70
M 516	42.48	26.6	2.70	1.80
MACS 6695	41.06	25.55	3.54	1.55
MACS 6696	41.27	28.95	3.02	1.65
MP 1331	35.23	28.47	2.90	1.15
NIAW 3170	44	26.47	3.58	0.50
NIAW 3212	50.94*	26.86	3.44	1.70
RIL-S1-126	42.12	23.89	3.25	1.05
RIL-S1-38	45.12	25.46	2.72	1.40
RW 5	43.15	28.86	3.52	2.00*
WH 1235	48.67*	27.57	3.28	1.35
DBW 93(C)	35.44	27.50	3.68	1.50
MP 3288(C)	35.33	26.55	3.23	1.35
K 1317(C)	35.21	30.12	4.11	1.80
NI 5439(C)	36.88	27.89	3.59	1.80
C 306(C)	49.91	27.57	4.14	1.40
GM	43.98	27.32	3.35	1.37
SE (m) ±	1.40	1.56	0.20	0.21
CD at 5%	3.92	4.38	0.57	0.59
"F" test	SIG	SIG	SIG	SIG

***-** Level of significance at 5%

1.8 Grain weight/ spike (g).

The data presented in table 4.4 revealed that, Grain weight/ spike (g) was found maximum under normal irrigated condition (4.14 g) in relation to non-irrigated (rainfed) condition (2.00 g) in wheat. The reduction in Grain weight/ spike was caused due to high moisture stress induced by non-irrigated (rainfed) condition. Similar results were reported by Hasan *et al.* (2010).

1.9 Grain yield (Kg/ ha).

Under normal irrigated condition, only one genotype GW 477 (3640.6Kg/ ha) showed statistical significance for grain yield (Kg plot^{-1}) over check. In case of non-irrigated condition, Genotype MACS 6696 (2130.91 Kg/ ha) recorded the significantly highest grain yield. Genotypic differences in grain yield might be due to genetic potential of different varieties to express in terms yield attributing traits in differential sowing environment conditions.

1.10 Biological yield (Kg plot^{-1}).

The data pertaining to biological yield (Kg plot $^{-1}$) presented in table 4.5. However, numerically maximum biological yield was recorded in normal irrigated condition (0.64 Kg plot $^{-1}$) and minimum in non-irrigated condition (rainfed) condition.

Table 5: Mean performance of different genotypes under normal irrigated and non-irrigated condition for grain yield (kg/ha) and biomass (kg/plot).

Treatment	Grain yield (Kg/ha)		Biomass (Kg/ plot)	
	Normal Irrigated	Non-Irrigated	Normal Irrigated	Non-Irrigated
BRW 3806	2612.2	1385	0.62	0.30
DBW 110	2295.3	1227.5	0.63	0.32
DBW 136	2764.2	1777.8	0.54	0.37
DBW 166	2663.8	1276.8	0.62	0.38
DBW 252	2262.4	1417.4	0.58	0.34
GW 477	3640.6*	1061.8	0.67	0.24
HD 3237	2224.1	1172.5	0.7	0.24
HI 1620	2316.3	1574.9	0.54	0.34
HI 1628	2975.4	1474.9	0.72	0.33
JWS 810	2793.8	1251.7	0.63	0.26
M 516	2243.2	1318.8	0.61	0.27
MACS 6695	2470.7	2130.9*	0.53	0.42*
MACS 6696	3132.1	1347.8	0.65	0.30
MP 1331	2594.5	1395.6	0.56	0.39
NIAW 3170	3126.4	1293.7	0.76	0.30
NIAW 3212	2144.8	1234.8	0.52	0.29
RIL-S1-126	2054.0	1617.9	0.46	0.35
RIL-S1-38	2646.6	1728.5	0.64	0.47*
RW 5	2570.1	1491.8	0.52	0.38
WH 1235	2739.3	1787.4	0.52	0.43*
DBW 93(C)	4432.98	1638.657	0.86	0.37
MP 3288(C)	3047.06	1451.215	0.79	0.33
K 1317(C)	4013.37	1806.771	0.83	0.31
NI 5439(C)	3540.27	1446.383	0.84	0.38
C 306(C)	4096.33	1622.7	0.79	0.41
GM	2856.00	1477.334	0.64	0.34
SE (m) ±	293.53	154.90	0.07	0.03
CD at 5%	823.48	434.55	0.21	0.09
"F" test	SIG	SIG	SIG	SIG

***-** Level of significance at 5%.

(0.34 Kg plot $^{-1}$) in wheat crop. Similar results were reported by Akbari *et al.* (2011) [1], Aslam *et al.* (2014) [3], Mobasser *et al.* (2014) [8].

2. Physiological parameters

2.1 Chlorophyll content index (CHL 1) (At 15 days after anthesis).

Data recorded on chlorophyll content index are presented in Table 4.7. It was evident that CCI was significantly increased under normal irrigated condition (47.56) in comparison to non-irrigated (rainfed) condition (42.16). It might be due to loss of chlorophyll content index under water stress is considered a main cause of inactivation of photosynthesis. Similar results were reported by Taiz and Zeiger (2006), Tas and Tas (2007) [19].

2.2. Chlorophyll content index (CHL 2) (21 days after anthesis).

The data regarding chlorophyll content index are presented in table 4.7 revealed that, the CCI was found increased under normal irrigated condition (39.45) as compared to non-irrigated condition (rainfed) condition (16.01) of wheat crop. Similar results were reported by Saeidi and Abdoli (2015) [12], Sheoran *et al.* (2015) [15].

Genotype MACS 6695 (22.23) recorded highest value for chlorophyll content index at 21 days after anthesis non-irrigated condition.

Table 6: Mean performance of different genotypes under normal irrigated and non-irrigated condition for Chlorophyll content index at 15 and 21 days after anthesis.

Treatment	Chlorophyll content index at 15 days after anthesis		Chlorophyll content index at 21 days after anthesis	
	Normal Irrigated	Non-Irrigated	Normal Irrigated	Non-Irrigated
BRW 3806	42.26	40.55	41.03	16.18
DBW 110	42.9	41.41	41.7	16.8
DBW 136	45.33	42.56	30.24	13.23
DBW 166	51.42	45.45*	32.02	14.07
DBW 252	46.81	39.57	43.97	13.51
GW 477	44.29	44.55*	41.62	14.45
HD 3237	48.51	41.86	26.79	13.83
HI 1620	51.39	41.62	47.96*	18.59
HI 1628	48.22	37.85	44.47	14.59
JWS 810	39.78	42.46	31.38	15.33
M 516	46.32	38.87	40.36	14.45
MACS 6695	48.43	40.86	42.03	22.23*
MACS 6696	49.02	43.97*	35.01	14.23
MP 1331	50.16	40.51	42.99	17.66
NIAW 3170	45.53	41.6	39.33	14.72
NIAW 3212	45.34	45.62*	41.07	14.36
RIL-S1-126	51.71	42.86	30.78	18.34
RIL-S1-38	47.36	47.06*	35.09	13.03
RW 5	47.75	44.52*	37.01	14.19
WH 1235	47.7	37.59	31.6	13.99
DBW 93(C)	49.24	36.80	44.98	14.19
MP 3288(C)	47.66	45.50	41.07	13.34
K 1317(C)	49.02	44.52	47.36	18.99
NI 5439(C)	49.64	40.62	45.11	21.23
C 306(C)	55.47	45.24	51.31	24.73
GM	47.65	42.16	39.45	16.01
SE (m) ±	3.02	2.51	4.24	2.30
CD at 5%	8.48	7.04	11.89	6.44
"F" test	SIG	SIG	SIG	SIG

***-** Level of significance at 5%.

2.3 Canopy temperature (^{0}C) (at 15 days after anthesis)

The data pertaining to canopy temperature (^{0}C) are presented in table 4.8 revealed that, increase in canopy temperature was observed with non-irrigated (rainfed) condition (29.04^{0}C) relative to normal irrigated condition (27.07^{0}C) 15 days after anthesis. Similar results were reported by Siddique *et al*. (2000) [17].

2.4 Canopy temperature (^{0}C) (at 21 days after anthesis)

The data on canopy temperature at 21 days after anthesis table 4.8 revealed that, canopy temperature was more under non irrigated (rainfed) condition (35.70^{0}C) compared to normal irrigated condition (34.58^{0}C). It might be due to under non-irrigated condition stomata close because of reduced water status, leaf temperature rises above ambient air temperature. Similar results were reported by Gautam *et al*. (2016) [5].

Table 8: Mean performance of different genotypes under normal irrigated and non-irrigated condition for Canopy temperature at 15 and 21 days after anthesis.

Treatment	Canopy temperature at 15 days after anthesis		Canopy temperature at 21 days after anthesis	
	Normal Irrigated	Non-Irrigated	Normal Irrigated	Non-Irrigated
BRW 3806	29.74	26.46*	36.42	34.10*
DBW 110	24.25	29.75	34.50	36.03
DBW 136	28.61	28.48	36.16	34.78*
DBW 166	29.25	29.71	35.25	36.42
DBW 252	30.16	29.37	36.61	35.49*
GW 477	27.18	27.64	32.82*	35.47*
HD 3237	26.96	26.63*	34.27	38.07
HI 1620	27.11	26.40*	35.74	35.64*
HI 1628	29.6	29.62*	32.57*	34.73*
JWS 810	25.3	31.53	36.34	34.73*
M 516	30.83	28.66	34.03	36.16
MACS 6695	27.93	28.81	32.68*	36.36
MACS 6696	29.97	32.27	33.55*	34.07*
MP 1331	14.38*	31.58	34.45	36.06
NIAW 3170	26.81	28.3	31.70*	35.40*
NIAW 3212	28.27	32.94	35.12	32.82*
RIL-S1-126	26.32	32.09	35.27	36.4
RIL-S1-38	26.77	26.25*	35.37	35.06*
RW 5	27.59	30.83	36.94	35.44*

WH 1235	27.26	28.26	34.25	37.34
DBW 93(C)	26.68	28.23	33.52	35.84
MP 3288(C)	28.71	27.43	37.33	38.20
K 1317(C)	26.92	29.45	33.63	35.28
NI 5439(C)	24.14	28.47	34.84	37.21
C 306(C)	26.13	26.79	31.05	35.30
GM	27.07	29.04	34.58	35.70
SE (m) ±	2.72	0.93	0.46	0.47
CD at 5%	7.63	2.62	1.29	1.32
"F" test	SIG	SIG	SIG	SIG

***-** Level of significance at 5%.

Conclusion

1. Sowing of wheat crop under normal irrigated condition significantly improved all the morpho-physiological characters viz. no. of productive tillers per meter at maturity, no. of grains spike^{-1}, grain weight/ spike, 1000 grain weight, biological yield, grain yield, harvest index, chlorophyll content index (at 15 and 21 days after anthesis), canopy temperature (at 15 and 21 days after anthesis) as compare to sowing of wheat under non-irrigated (rainfed) condition resulted in significantly increase in grain yield of wheat.
2. Among 25 different genotypes, GW 477 recorded significantly higher yield and physiological parameters as compared to any of the genotypes under normal irrigated and under non-irrigated condition, genotype MACS 6696 recorded highest grain yield and chlorophyll content index.

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