RESEARCH ARTICLE

PHYSIOLOGICAL RESPONSE OF IRANIAN WHEAT LANDRACES UNDER IRRIGATED, RESTRICTED IRRIGATED AND RAINFED CONDITIONS

Amandeep Kaur* and Rashpal Singh Sarlach[1]

Department of Botany, Punjab Agricultural University, Ludhiana 141004
[1]Department of Plant Breeding &Genetics, Punjab Agricultural University,Ludhiana,141004
Email: deepaman3305@gmail.com

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Abstrac: Drought is major abiotic stress thatinduce alterations in wheat physiology. The aim of present study was to investigate the effect of water stress on canopy temperature and chlorophyll content of 27 Iranian landraces along with commercial relevant checks under irrigated, Restricted irrigated and Rain-fed condition.Lines were selected on the basis of minimum reduction of vigor index under water stress induced by Polyethylene glycol (6000) as compared to control lines. A field experiment was carried out at experimental area of Department of Plant Breeding & Genetics, Punjab Agricultural University Ludhiana, Punjab during 2016-17 with three replications. Canopy temperature was recorded first at anthesis stage and then 10 days after anthesis. Chlorophyll content was recorded at regular interval from tagged plant from anthesis to maturity.IWA 8600179, IWA 8600064 and IWA 8600542 had lower canopy temperature whereas PETTERSONML68-10, IWA 8600596, IWA 8600064 and IWA 8600179 had maximum chlorophyll content under water stress.

Keywords: Anthesis, Chlorophyll content, Canopy temperature, Water stress

INTRODUCTION

Drought is major abiotic environmental stress affecting about 32% of 99 million hectares under wheat cultivation in developing countries and at least 60 million hectares under wheat cultivation in developed countries (Shamsi 2005).Under water stress there is alterations in wheat physiology. The major physiological attributes such as chlorophyll content and canopy temperature are severely affects under drought stress.Chlorophyll which is important componentof photosynthesis affects by water deficit during vegetative stage and flowering stage which results in decrease in chlorophyll a and b content (Mafakheri*et al.*, 2010).The change in content of chlorophyll content depends upon the severity and duration of drought (Kyparissis*et al.*, 1999).During water stress, thereis increase in electrolyte leakage which results in reduction of chlorophyll content (Teng *et al*., 2004). There is reduction in fixation of Co_2 under drought stress due to closure of stomata which decrease the rate of photosynthesis in plants. Chlorophyll content in leaves can be measured by a non-destructive, rapid and easy technique using SPAD meter. Canopy temperature is other physiological trait affects during water stress.Canopy temperature is indicator of plants ability maintaining soil moisture under water deficit.Generally canopy temperature in crop affects by amount of solar radiation hitting the canopy, water availability in soil and relative humidity (Reynold*et al*.,2001).Under water stress, canopy temperature is increased due to increase in rate of respiration and decrease in rate of transpiration due to closure of stomata(Siddique et al., 2000).There is significant association between physiological traits and yield contributing traits. Wheat Genotypes having high content of chlorophyll produce maximum productivity during stress conditions and plants having lower canopy temperature are able to produce high yield by maintaining water status (Reza 2011).Canopy temperature is easy and rapid approach for screening of tolerant genotypes under water stress in wheat.In globally drought affected areas physiological mechanism is very handy approach in evaluating and screening the extraordinary genotypes having drought resistant mechanism. Comprehensive information of physiological mechanisms permits plant researcher to develop promising genotypes that would be utilized efficiently, continue their growth and production under water deficit stage (Ashraf and Khan 1993).

MATERIALS AND METHODS

In order to evaluate the role of physiological traits that is chlorophyll content and canopy temperature efficiency to screen drought tolerantIranian landraces under water stress condition .A field experiment was carried out in the Department of Plant Breeding and Genetics, Punjab Agricultural University Ludhiana, during November 2016-17.27 lines were selected on the basis of vigor index from preliminary screening experiment. These lines showed minimum reduction as compared to control in all seedling parameters (germination percentage, coleoptile length, root length, shoot length, root and shoot fresh and dry weight at 14% Polyethylene glycol (6000) treatment(Kaur *et al*.,2018).27 Iranian landraces were grown under irrigated, restricted irrigated and rain-fed conditions.Control treatment (Irrigated) was well watered throughout the growing period (five

*Corresponding Author

irrigations) .Drought environment was created by withholding irrigation (two irrigations) and rain-fed condition (no irrigation).The experiment was carried out in RBD design with three treatments with three replications.Sowing was done in the last week of November 2016.Chlorophyll content was recorded at regular interval from tagged plant from anthesis to maturity by using chlorophyll content meter (SPAD Model CM 200).Canopy temperature was recorded first at anthesis stage and then 10 days after anthesis from each line by using infrared thermometer (Model LT-300) in cloudless, bright days with minimum wind movement between12:00noonto2. 00PM

Statistical analysis: The statistical analysis was carried out with the help of CPCS-1 software using RBD (Randomized block design) factorial.

RESULTS AND DISCUSSION

Analysis of variance for all the physiological traits was conducted. The mean square under drought stress were highly significant for canopy temperature at anthesis and canopy temperature 10 days after anthesis but non-significant for chlorophyll content at anthesis and chlorophyll content at post anthesis (Table 1) Under restricted irrigation mean square is significant for canopy temperature at anthesis and canopy temperature 10 days after anthesis whereas non-significant for chlorophyll content at athesis and chlorophyll content at post anthesis(Table2).Under rain-fed conditions mean square is highly significant for canopy temperature at anthesis and canopy temperature10 days after anthesis ,chlorophyll content at anthesis but non-significant for chlorophyll content at post anthesis (Table 3)

Mean value of Iranian landraces along with checks under irrigated condition are presented in (Table 7)under restricted irrigated condition in (Table 8) and under rain-fed condition in (Table 9).

Canopy temperature at anthesis (°C)

Canopy temperature recognized as indicator of overall water status and transpiration rate in plant. Plants having lower canopy temperature are able to maintain water status under stress conditions by taking moisture from the soil. Under drought stress, canopy temperature increasedueto increase in rate of respirationand decrease in rate of respiration due to closure of stomata (Siddique *et al*., 2000).

In case of irrigated condition a range of 21.5°C to 29.0°C canopy temperature was recorded in the set with an average of 25.2°C(Table 4). Among checks C-306 had highest (27.6°C) whereas minimum canopy temperature at anthesis was recorded in PBW 660 (24.5°C) (Table 4). In case of Iranian lines, IWA 8600796 had higher canopy temperature (29.0°C)followed by IWA 8600232 (28.4) whereas IWA 8600179 and IWA 8600542 had lowest (21.5°C) canopy temperature at anthesis (Table 7).Frequency distribution for canopy temperature at anthesis showedmajority of lines had canopy temperature in the range of 22.5 to26.5°C under irrigated condition (Figure A).Under restricted-irrigated condition canopy temperature at anthesis among genotypes varied between 23.5°C to 29.8°C with a mean of 26.6°C (Table 5). In commercial relevant checks, maximum canopy temperature at anthesis was recorded in C-518(28.5°C) and minimum in PBW175 (26.0°C) (Table 5). In Iranian lines, IWA 8600179 and IWA 8600715 had lowest (23.5°C) whereas IWA 8600841 (29.8°C) had highest canopy temperature at anthesis (Table 8).Frequency distribution for canopy temperature at anthesis showedmajority of lines had canopy temperature in the range of 27.5 to28.5°C under restricted irrigated condition (Figure B).In rain-fed condition canopy temperature at anthesis varied between 25.0°C to 31.5°C with an average of 25.7°C(Table 6). Among commercial relevant checks, Gladius had maximum canopy temperature (30.5°C) whereas minimum canopy at anthesis was recorded in C-306 (26.4°C) (Table 6). Among Iranian lines IWA 8600064 and IWA 8606258 had minimum(25.0°C) canopy temperature whereas IWA 8600846 had maximum (31.5°C) canopy temperature at anthesis (Table 9).Frequency distribution for canopy temperature at anthesis showedmajority of lines had canopy temperature in the range of 29.0to30.0°C under rain-fedcondition(Figure C).

Canopy temperature 10 days after anthesis (°C)

In case of irrigated condition a range of 23.5C to 29.5°C canopy temperature at 10 days after anthesis was recorded in the set with an average of 27.0°C canopy temperature at 10 days after anthesis(Table 4). Among checksPBW 660 hadminimum(25.5°C) whereas maximum canopy temperature at 10 days after anthesis was recorded in PBW 175 and C-518 (28.5°C) (Table 4). In Iranian lines,IWA 8600179had lowest(23.5°C)canopy temperature at 10 days after anthesis whereas IWA 8600796 had highest (29.5°C) canopy temperature at 10 days after anthesis (Table 7).Frequency distribution for canopy temperature at anthesis showed majority of lines had canopy temperature in the range of 27.5 to28.5°C under irrigated condition (Figure A).Under restricted irrigated range of 25.5°C to 30.5°Ccanopy temperature at 10 days after anthesis was recorded in the set with an average of 25.9°C (Table 5). Among commercial relevant checks C-518 and C-306 had lowest(27.2°C) whereas BWL5233 hadhighest (29.5°C) canopy temperature at 10 days after anthesis (Table 5). In Iranian lines IWA 8600179 had minimum (25.5°C) canopy temperature whereas IWA 8600440 had maximum (30.5°C) canopy temperature at 10 days after anthesis (Table 8).Frequency distribution for canopy temperature at anthesis showedmajority of lines had canopy temperature in the range of 27.5 to28.5°C under restricted irrigated condition (Figure B).In rain-fed condition canopy temperature at 10 days after anthesis among genotypes varied between 27.5°C to

33.5°C with an average of 26.0°C (Table 6). Among commercial relevant checks, C-591 had lowest (29.2°C) canopy temperature whereas Gladius had maximum (32.5°C) canopy temperature 10 days after anthesis (Table 6). Among Iranian lines IWA 8600064 had lowest (27.5) canopy temperature at 10 days after anthesis whereas highest (33.5°C) canopy temperature was recorded in IWA 8600883 (Table 9).Frequency distribution for canopy temperature at anthesis showedmajority of lines had canopy temperature in the range of 29.2 to30.2°C under rain-fed condition (Figure C).

Moslem *et al* (2013) found in wheat, drought tolerant genotypes had cooler canopy and drought sensitive genotypes had hotter canopy in rain-fed condition. Similar result had been found by Bilge *et al* 2008.

Chlorophyll content (SPAD value)at anthesis

Chlorophyll content is one of the important factor affecting photosynthetic capacity in plant. (Nageswara*et al*.,2001).Water stress reduces the photosynthetic activity in plants by affecting chlorophyll components and photosynthetic apparatus (Iturbe Ormaetxe *et al*.,1998) .Under stress there is production in active oxygen species which ultimately damage the chloroplast of plants (Smirnoff 1995) The wheat genotypes having high chlorophyll content they are resistant to drought stress and are able to produce high yield under stress conditions.

In irrigated condition chlorophyll content at anthesis varied between24.5 to 33.2 with an averageof 28.5(Table 4). Among commercial relevant checks BWL 5233 had highest (31.2) while PBW 660 had lowest (29.0) chlorophyll content at anthesis (Table4). Among Iranian lines, PETTERSONML68-10 had maximum (33.2) followed by IWA8600596 and IWA 8600064 (33) whereas minimum chlorophyll content was recorded in IWA 860756 (24.5). (Table 7).Frequency distribution for chlorophyll content at anthesis showedmajority of lines had chlorophyll content in the range of 28.5 to29.5°C under irrigated condition (Figure A).

Under restricted-irrigated chlorophyll content at anthesis varied between19.6to 26.5 with a mean of23.0(Table 5). In commercial relevant checks C-518 had highest (27.4) while Gladius and BWL 5233 had lowest (20.5) chlorophyll content at anthesis (Table 5). Among Iranian lines, IWA 8600179 had maximum (26.5) followed by IWA 8600064 (25.5) and IWA 8600091(25.3) whereas minimum chlorophyll content was recorded in IWA 8600796 (19.6) (Table 8).Frequency distribution for chlorophyll content at anthesis showedmajority of lines had chlorophyll content in the range of 23.6 to 24.6°C under restricted irrigated condition (Figure B).Under rain-fed condition, chlorophyll content at anthesis varied between 15.5 to 25.0 with a mean of 20.2 (Table 6). Among commercial relevant checks C-591 had highest (22.5) while BWL5233 lowest (18.5) chlorophyll content at anthesis (Table 6). Among Iranian lines, IWA 8600064 had maximum(25.0) followed by IWA 8600179 (24.5) whereas minimum (15.5) chlorophyll content was recorded in IWA 8606753 and IWA 8600542(Table 9).Frequency distribution for chlorophyll content at anthesis showed majority of lines had chlorophyll content in the range of 18.5 to19.5°C under restricted irrigated condition (Figure C).

Chlorophyll content (SPAD value) at post anthesis:

In irrigated condition chlorophyll content at post anthesis varied between 22.5 to 30.5 with an average 26.5 (Table 4). Among commercial relevant checks C-518 had highest (28.9) while BWL 5233 had lowest (24.0) chlorophyll content at post anthesis (Table 4). Among Iranian lines, IWA 8600596 and IWA 8600064 had maximum (30.5) whereas minimum chlorophyll content at post anthesis was recorded in 8607572 (22.5) (Table 7).Frequency distribution for chlorophyll contente at anthesis showedmajority of lines had chlorophyll content in the range of 23.6 to24.6°C under restricted irrigated condition (Figure A).

Under restricted-irrigated chlorophyll content at post anthesis varied between 16.2 to 24.5 with a mean of 20.3 (Table 5). In commercial relevant checks C-518 had highest (24.5) while Gladius had lowest (16.5) chlorophyll content at post anthesis (Table 5). Among Iranian lines IWA 8600179 had maximum (24.5) followed by PETTERSONML68-10 and IWA 8600064 (23.0) whereas minimum (16.2) chlorophyll content at post anthesis was recorded in IWA 8606633(Table 8).Frequency distribution for chlorophyll content at anthesis showed majority of lines had chlorophyll content in the range of 20.2 to21.2°C under restricted irrigated condition (Figure B). Under rain-fed condition, chlorophyll content at post anthesis varied between 14.5 to 21.2with amean of 17.8 (Table 6). In commercial relevant checks C-518 had highest (19.8) while Gladius had lowest (15.0) chlorophyll content at post anthesis (Table 6). Among Iranian lines, IWA 8600064 had maximum (21.2) followed by IWA 8600091 and PETTERSONML68-10 (20.0) whereas minimum chlorophyll content at post anthesis was recorded in IWA 8600796 (14.5) (Table 9).Frequency distribution for chlorophyll content at anthesis showedmajority of lines had chlorophyll content in the range of 16.5 to 17.5°C under rain-fed condition (Figure C).

Tayeb (2006) found that chlorophyll content decreased at faster rate in drought sensitive genotypes as compared to tolerant genotypes. There was reduction in chlorophyll content under restricted and rain-fed conditions. Naeem *et al* (2015) observed that Chlorophyll content decreased under lower water supply treatments similar result had been found by (Chachar *et al*.,2016) that reduction in chlorophyll content under water stress which is consistent with our findings.

Table 1. Analysis of variance for physiological traits in 27 Iranian lines along with 8 checks under Irrigation condition during 2016-17

Source of variation	Df	CT A (°C)	CT10 (°C)	CHLA	CHLPA
Block	1	0.120536	3.002232	257.6313	114.2036
Treatment	34	4.748047*	6.12454*	12.64074	6.12454
Error	34	2.277736	2.738905	9.345503	2.506988

Table 2. Analysis of variance for physiological traits in 27 Iranian lines along with 8 checks under Restricted irrigated condition during 2016-17

Source of variation	Df	CT A (°C)	CT10 (°C)	CHL A	CHLPA
Block	1	0.209*	1.97*	32.09	17.52
Treatment	34	16.105*	19.74*	17.38	8.82
Error	34	2.69	2.50	13.57	9.82

Table 3. Analysis of variance for physiological traits in 27 Iranian lines along with 8 checks under Rain-fed condition during 2016-17

Source of variation	Df	CTA(°C)	CT10(°C)	CHL A	CHLPA
Block	1	22.62	3.65	0.31	0.22
Treatment	34	8.85*	6.74*	37.39*	19..84
Error	34	1.80	1.98	12.49	9.34

Abbreviations: DF –Degree of freedom CTA –Canopy temperature at anthesis, CT10- Canopy temperature at 10 days after anthesis CHLA- Chlorophyll content at anthesis, CHLPA-Chlorophyll content at post anthesis

Table 4. Ranges and mean values of Physiological traits of Iranian lines and checks under irrigated condition

Characters		CTA	CT10	CHLA	CHLPA
Landraces	Min	21.5	23.5	24.5	22.5
Mean value of checks	Max	29	29.5	33.2	30.5
	Mean	29.2	27	28.5	26.5
	Gladius	26	26.5	28.5	25
	BWL 5233	25	27.5	31.2	24
	C-306	27.6	27.5	29.5	24.3
	PBW 660	24.5	25.5	29	24.1
	C- 518	27.5	28.5	29.2	28.9
	C-591	25.4	28	28.5	27.9
	C-273	27.2	26.5	29.2	25.2
	PBW 175	25.2	28.5	28.5	25.2

Table 5. Ranges and mean values of Physiological traits of Iranian lines and checks under Restricted irrigated condition

Characters		CTA	CT10	CHLA	CHLPA
Landraces	Min	23.5	25.5	19.6	16.2
Mean value of checks	Max	29.8	30.5	26.5	24.5
	Mean	26.6	25.9	23	20.3
	Gladius	28	28.5	20.5	16.5
	BWL 5233	27.5	29.5	20.5	17.5
	C-306	27	27.2	22.5	17.7
	PBW 660	28	27.5	24.7	23.7
	C- 518	28.5	27.2	27.4	24.5
	C-591	27.8	28.5	24.5	18.5

	C-273	27	27.5	24.3	22
	PBW 175	26	27.5	23.2	20.5

Abbreviations: CTA –Canopy temperature at anthesis, CT10- Canopy temperature at 10 days after anthesis CHLA- Chlorophyll content at anthesis, CHLPA- Chlorophyll content at post anthesis

Table 6. Ranges and mean values of Physiological traits of Iranian lines and checks under Rain-fed condition

Characters		**CTA**	**CT10**	**CHLA**	**CHLPA**
Landraces	Min	25	27.5	15.5	14.5
Mean value of checks	Max	31.5	33.5	25	21.2
	Mean	25.7	26	20.2	17.8
	Gladius	30.5	32.5	19.5	15
	BWL 5233	28.5	29.9	18.5	17
	C-306	26.4	27.2	19.8	15.5
	PBW 660	27.5	29.5	20.5	19.5
	C- 518	28.2	29.5	20.5	19.8
	C-591	27.5	29.2	22.5	17.5
	C-273	28	27.8	20.2	19
	PBW 175	27.5	29.5	19.5	17.2

Abbreviations: CTA –Canopy temperature at anthesis, CT10- Canopy temperature at 10 days after anthesis CHLA- Chlorophyll content at anthesis, CHLPA- Chlorophyll content at post anthesis

Table 7. Mean values of Physiological traits of Iranian lines and checks under Irrigated condition

Sr.No	Germplasm	CTA	CT10	CHLA	CHLPA
1	PETTERSON ML68-10	23	24.5	33.2	30.4
2	Cltr 15395	25.4	27.8	27.5	25.5
3	IWA 8600064	22.5	24.5	33	30.5
4	IWA 8600091	25.5	27.5	29.2	27
5	IWA 8600179	21.5	23.5	30.2	27
6	IWA 8600191	25.5	27.8	26.5	25
7	IWA 8600232	28.4	28.5	27.5	24.5
8	IWA 8600397	27.2	27.5	27.25	25.25
9	IWA 8600435	24.5	25.5	28	25
10	IWA 8600440	26.7	27.5	27.5	28
11	IWA 8600542	21.5	26.5	28	27.25
12	IWA 8600567	25.5	25.5	29.2	28
13	IWA 8600596	24.4	28.5	33	30.5
14	IWA 8600715	25.5	27.8	29.8	28.4
15	IWA 8600795	26.4	27	29	28.5
16	IWA 8600796	29	29.5	27.1	24.5
17	IWA 8600841	23.5	25.5	29.5	24.5
18	IWA 8600846	24.2	25.5	28.5	24.5
19	IWA 8600883	24	26.5	29.2	27.75
20	IWA 8606258	23.5	26	29.25	25.5
21	IWA 8606633	24.4	25.5	27	25
22	IWA 8606661	24.5	27.5	28.5	28
23	IWA 8606739	24.5	26.5	28.5	28
24	IWA 8606753	25.5	27	29	27.5
25	IWA 8606741	25.6	26.5	29.5	24.5
26	IWA 8607572	24	25.5	28.5	22.5
27	IWA 8607576	24.5	25	24.5	23.5
28	Gladius	26	26.5	28.5	25
29	Bwl 5233	25	27.5	31.25	24.05
30	C-306	27.6	27.5	29.5	24.35
31	PBW660	24.5	25.5	29	24.15

32	C-518	27.5	28.5	29.2	28.9
33	C-591	25.4	28	28.5	27.95
34	C- 273	27.2	26.5	29.2	25.25
35	PBW175	25.5	28.5	28.5	25.25
	CD (5%)	3.36	23.9	3.33	16.3

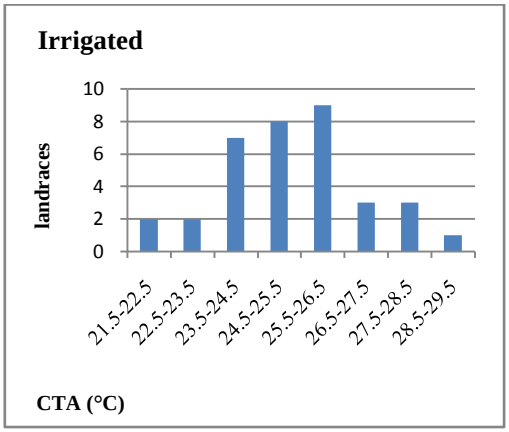
Table 8. Mean values of Physiological traits of Iranian lines and checks under Restricted irrigated condition

Sr.No	Germplasm	CTA	CT10	CHLA	CHLPA
1	PETTERSON ML68-10	24.5	26.5	25.2	23
2	Cltr 15395	28.4	29.5	20.5	20
3	IWA 8600064	24	26	25.5	23
4	IWA 8600091	26.2	27.5	25.3	21
5	IWA 8600179	23.5	25.5	26.5	24.5
6	IWA 8600191	25.2	27.5	22.8	19.25
7	IWA 8600232	27.7	28.5	21.65	19.5
8	IWA 8600397	25.5	27.5	21.6	19.25
9	IWA 8600435	27.7	29.5	24.15	21.25
10	IWA 8600440	28.4	30.5	22	20.5
11	IWA 8600542	27.5	28.7	21.45	19.5
12	IWA 8600567	29.5	29.8	20.4	17
13	IWA 8600596	28.75	29.5	24	18.25
14	IWA 8600715	23.5	29	22.3	20.75
15	IWA 8600795	28.3	29.5	24.5	20.5
16	IWA 8600796	27.5	29.4	19.65	18.6
17	IWA 8600841	29.8	27.5	20.75	21.25
18	IWA 8600846	27.2	28.5	21.55	21.25
19	IWA 8600883	27.5	27.5	22.5	18.75
20	IWA 8606258	25.5	28.5	20.5	20.5
21	IWA 8606633	26.5	27.8	24.4	16.2
22	IWA 8606661	26	27.5	24.6	18.7
23	IWA 8606739	25.2	28	24.5	19
24	IWA 8606753	26.5	27.5	20.9	18.7
25	IWA 8606741	26	27.5	20.3	18
26	IWA 8607572	27	28.5	24	22.5
27	IWA 8607576	25.5	27.5	21.3	21
28	Gladius	28	28.5	20.5	16.5
29	Bwl 5233	27.5	29.5	20.5	17.5
30	C-306	27	27.2	22.5	17.7
31	PBW660	28	27.5	24.7	23.7
32	C-518	28.5	27.2	27.4	24.5
33	C-591	27.8	28.5	24.5	18.5
34	C- 273	27	27.5	24.3	22
35	PBW175	26	27.5	23.2	20.5
	CD (5%)	3.33	16.3	NS	NS

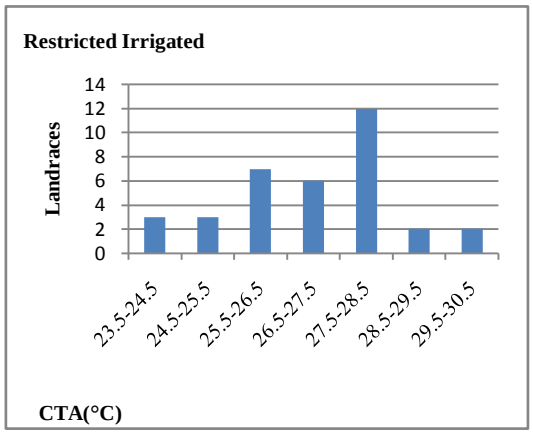
Table 9. Mean values of Physiological traits of Iranian lines and checks under Rain-fed condition

Sr.No	Germplasm	CTA	CT10	CHLA	CHLPA
1	PETTERSON ML68-10	26	32.3	24	20
2	Cltr 15395	29.4	30.5	19.5	17
3	IWA 8600064	25	27.5	25	21.2
4	IWA 8600091	28.2	28.5	22.75	20
5	IWA 8600179	27.7	28	24.5	17.5
6	IWA 8600191	29.7	30.5	17.5	17
7	IWA 8600232	29.2	30.5	18.5	16.5
8	IWA 8600397	29.7	30.5	18.5	15
9	IWA 8600435	29.5	30	20.5	17.8
10	IWA 8600440	30.4	29.5	17.8	15.5
11	IWA 8600542	28.2	29.5	15.5	15
12	IWA 8600567	30.3	30.8	17.5	15.5
13	IWA 8600596	30.2	31.2	18	16.5
14	IWA 8600715	29.1	30.3	20.5	18.5
15	IWA 8600795	30.2	30.6	21.5	17.5
16	IWA 8600796	29.4	31.5	17.5	14.5
17	IWA 8600841	25.5	32.5	19	18.7
18	IWA 8600846	31.5	29.5	20.5	18.9
19	IWA 8600883	29	33.5	18.5	16.5
20	IWA 8606258	25	30.5	18.5	17.9
21	IWA 8606633	29.8	29.2	19.5	18.5
22	IWA 8606661	27.5	27.7	17.8	15.8
23	IWA 8606739	26.5	27.5	22.5	17.6
24	IWA 8606753	25.5	29.5	15.5	15
25	IWA 8606741	28	28.5	18.5	17.5
26	IWA 8607572	28.5	29.5	17.5	17
27	IWA 8607576	27.4	28.5	18.5	15.5
28	Gladius	30.5	32.5	19.5	15
29	Bwl 5233	28.5	29.9	18.5	17
30	C-306	26.4	27.2	19.8	15.5
31	PBW660	27.5	29.5	20.5	19.5
32	C-518	28.2	29.5	20.5	19.8
33	C-591	27.5	29.2	22.5	17.5
34	C- 273	28	27.8	20.2	19
35	PBW175	27.5	29.5	19.5	17.2
	CD (5%)	2.72	10.7	7.18	NS

Figure 1: Frequency distribution of Iranian landraces (A) canopy temperature at anthesis and after 10 days of anthesis under irrigated condition. (B)Canopy temperature at anthesis and after 10 days of anthesis under restricted irrigated condition. (C)canopy temperature at anthesis and after 10 days of anthesis under rain-fed condition.



(A)



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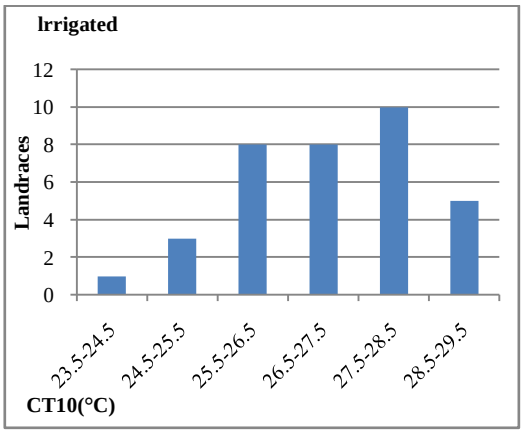
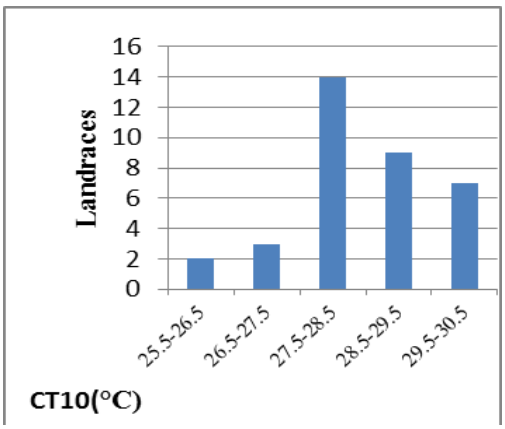
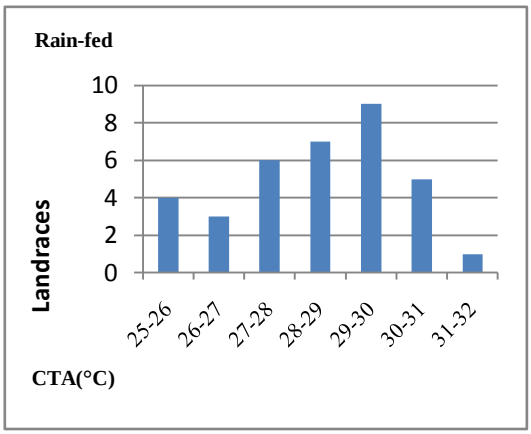


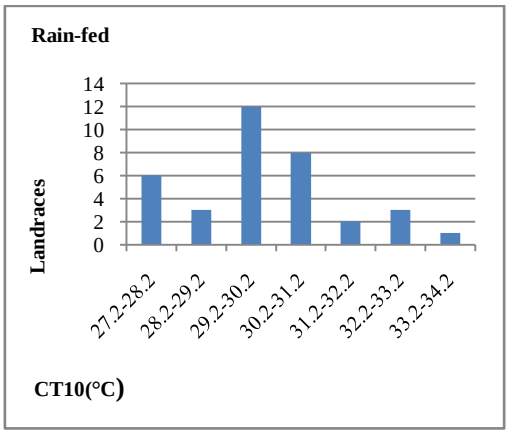
(C)



(D)

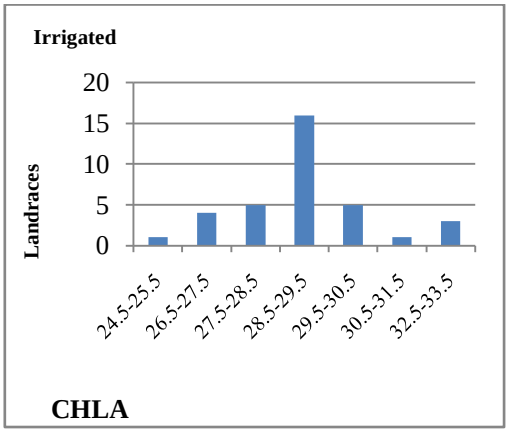


(E)

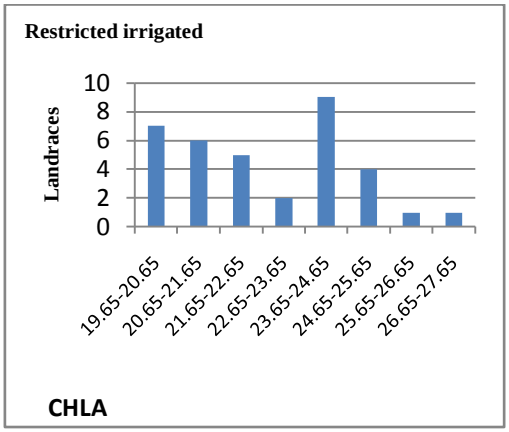


(F)

Figure 2: Frequency distribution of Iranian landraces (A) Chlorophyll content at anthesis and at post anthesis under irrigated condition. (B) Chlorophyll content at anthesis and at post anthesis under restricted irrigated condition. (C) Chlorophyll content at anthesis and at post anthesisunder rain-fed condition**.**



(A)



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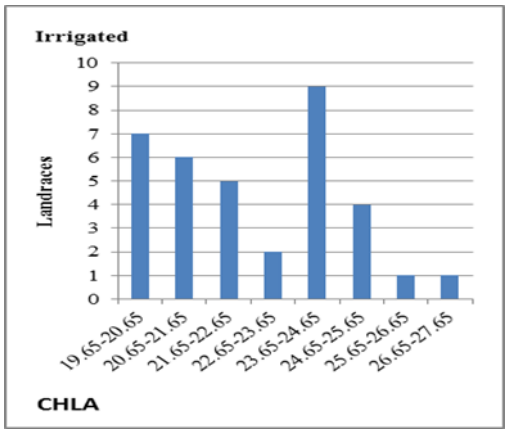

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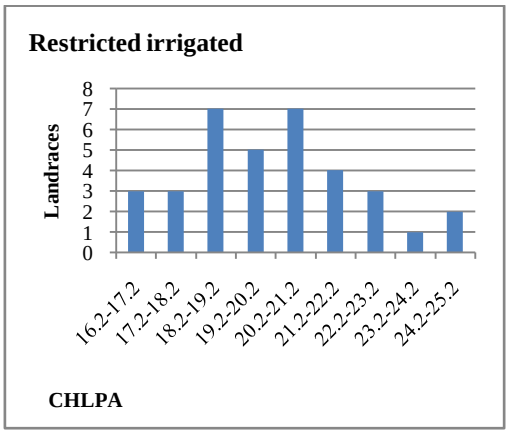

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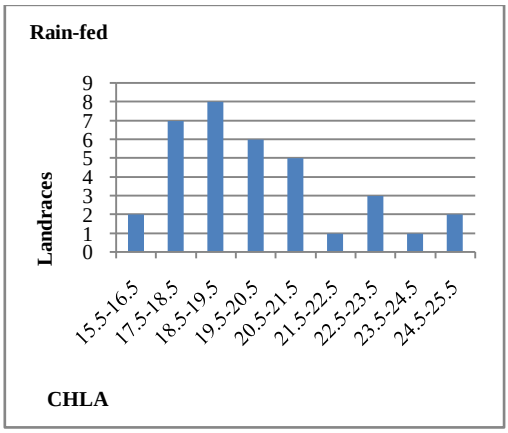

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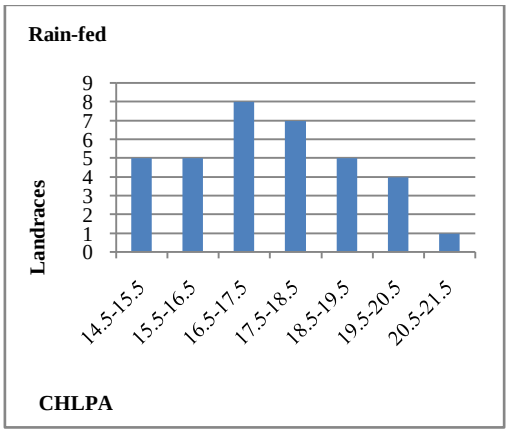

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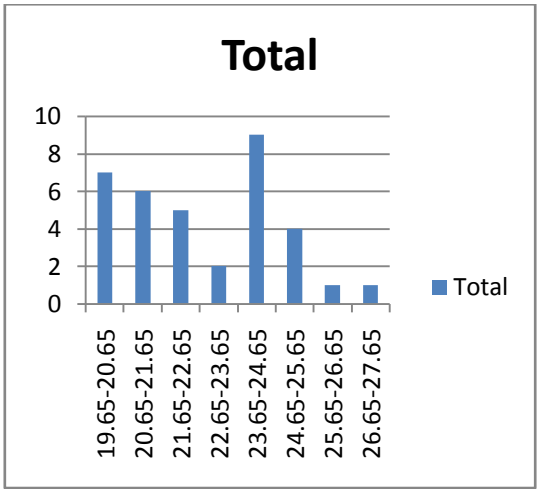

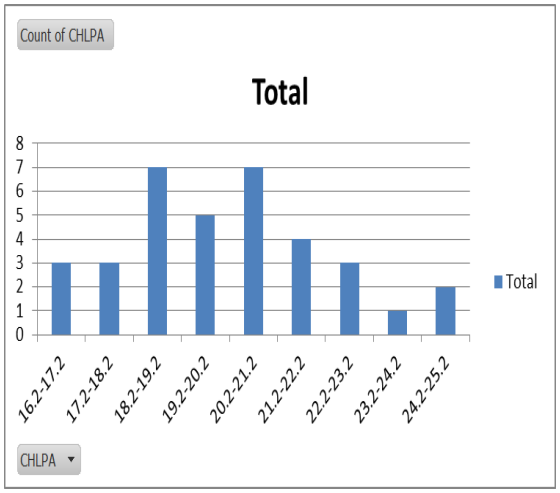

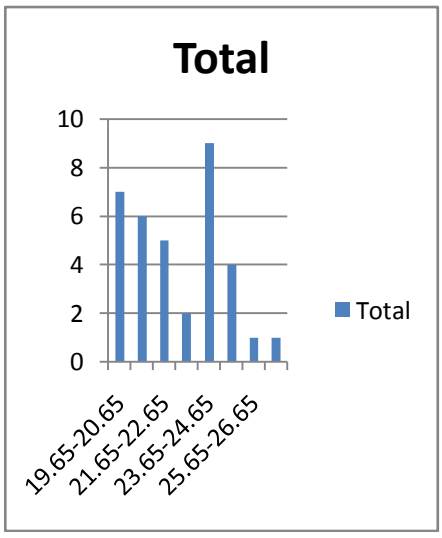

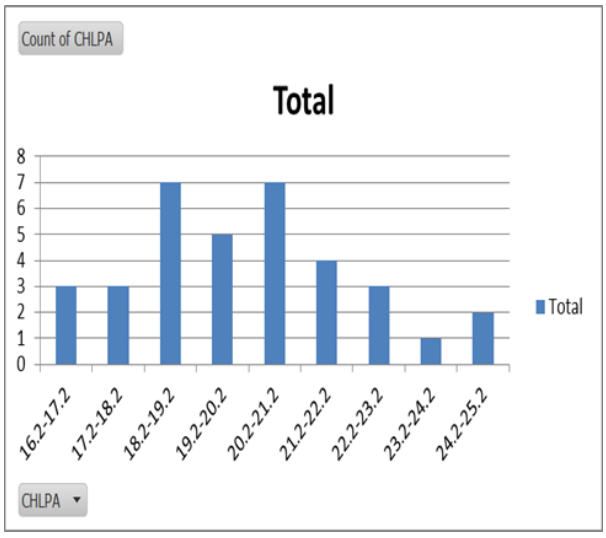

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