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Screening of maize genotypes for moisture stress tolerance

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Abstract
Drought is an important environmental constraint that limits the productivity of cereals and affects both quality and quantity of yield. Field experiment was conducted at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during *rabi*/summer season 2013-14 to evaluate maize genotypes for moisture stress condition. The experiment was laid out in FRCBD with three replications consisting of 150 maize genotypes. Moisture stress significantly affected the morpho-physiological traits and finally the yield. The morpho-physiological traits like plant height, number of leaves leaf area and total dry matter accumulation. Bio-chemical traits *viz.*, photosynthetic rate, transpiration rate and yield were recorded significantly highest under the irrigated condition and lowest in the water stress conditions. The genotypes which performed better in both irrigated and stress situation was categorized as drought tolerant and the genotypes with poor performance were categorized as drought susceptible.

Keywords: Maize, moisture, tolerance *Zea mays* L.

Introduction

Maize (*Zea mays* L.) is one of the most important cereal grains grown in larger number of countries because of its suitability to wider range of environments and greater adaptability. It is one of the most important cultivated grain crops around the world and is widely used to provide food, forage, and industrial raw materials. The global maize production was 1068.79 million tonnes from an area of about 183.57 million hectare with productivity of 5.82 tonne/ha (Anonymous, 2017) [4]. In India, maize is grown over an area of 8.5 million ha with production of 21 million tonnes and a productivity is 2470 kg per ha. The yield and production of maize surpasses wheat and rice. Maize is in higher demand as animal feed than its demand for human food, particularly in Asia, where a doubling of production is expected from the 2 present level of 165 million tonnes to almost 400 million tonnes in 2030.

Water is a prime requisite of every organism including the plants. Any dearth in the specified requirement imposes stressful conditions. Water demand is variable across the tissues and across the expansion stages of same species of crop plant and maize crop has no exception thus, far. The early stages of maize growth require minimum water whereas, the requirement increases during the reproductive growth stages. Pollination stage is most critical growth stage for water requirement and grain yield is also decided at this stage. Grain filling and soft dough formation are most sensitive to water deficiency, whereas, pre-tasseling and physiological maturity are comparatively insensitive to water deficiency.

Drought stress usually occurs when the soil moisture availability is substantially reduced and the atmospheric conditions and high temperature cause continuous loss of water by evaporation and transpiration. Drought is a serious problem in the state having the annual rainfall of 750mm or less. Prolonged drought during the critical stages of plant growth affects the metabolism. When the soil moisture falls, plants attain a state of permanent wilting where it cannot recover its turgor even during cool house of light. Almost all plant species show tolerance to stress but the extent varies from plant to plant and species to species. Hence, the need for securing the varieties of crops capable for escaping the injurious effects of drought becomes apparent, because nearly 60 to 80 per cent of the cultivated land has to end use season and drought.

The progress in developing crop cultivars for tolerance to abiotic stress particularly drought has been slow, because of lack of knowledge of the mechanisms of tolerance and lack of efficient techniques for screening germplasms (Kush, 1998) [14]. Studying the physiological changes of plant to moisture stress condition serves as relative assessment tool that redirects adaptive mechanism of genotype. Therefore, the present study on “Screening of maize genotypes for moisture stress condition” was carried out comparing the physiological response and yield loss of crop under water stress condition compared to normal condition.

Materials and Method

The field experiment was carried out during *rabi/summer season*, 2013-14under two different water regimes (Irrigated and Stress) at Main Agricultural Research Station (MARS), Dharwad, to evaluate the maize genotypes for moisture stress condition. 150maize genotypes were selected and screened. The experiment was laid under Factorial RCBD design with two replications. Two blocks were made in the field to fit two water regimes (Irrigated and stress blocks). The block selected for stress imposition was bordered at 1 meter depth with blue polythene sheet in order to prevent the lateral movement of water. Stress was created by withholding the irrigation after 30 days of sowing up till harvest of the crop whereas, 100 per centfield capacity was maintained in the irrigated block. The moisture depletion pattern under moisture stress imposition was recorded periodically till harvest. There were no rains received during the experimentation period. The morpho-physiological observation *viz.,* plant height, no. of green leaves, leaf area and physiological parameters was recorded in five randomly selected plants in a plot of each treatment. The total dry matter and its distribution in leaf, stem and reproductive parts was worked out from the average of three randomly selected plants which were dried at 80 ^{0}C till a constant weight and is expressed as g/plant. Measurement of rate of photosynthesis and stomatal conductance was made on the top fully expanded leaf at different growth stages by using portable photosynthesis system (LI-6400 LICOR, Nebraska, Lincoln USA).

Results and Discussion

Water stress strongly affected the expression of morphological traits and the resulting impact was negative for the plant growth and development. The effect of water stress is not uniform at all the stages of plant and its effects on morphological traits depend not only on the magnitude but also on the stage at which it occurs.

Plant height is probably the most conspicuous trait subjected to natural selection in crops. Even slight superiority in height can give a plant, through advantageous competition for light. Tallness had certain advantages for early cereal cultivators, and such advantages can still be important for some subsistence agricultural systems around the world. In general, plant height increased with the growth of the crop till harvest. Plant height significantly varied among the irrigated and stress conditions and among the hybrids. The plant height was significantly reduced in the stress situation as compared to irrigate situation at all the crop growth stages. At the mean plant height was lowest in stress conditions (180.01cm) as against the irrigated conditions (190.77 cm). Plants growth depends on cell division and expansion which generally require sufficient amount of water and hence plants tend to grow taller under irrigated conditions (Naidu, 1992) [19]. Similarly, Liu *et al.,* 2004 reported on reduced plant height with increase in the intensity of the drought. Water deficits at critical growth stages severely affected the plant height of maize hybrids (Kheir and Mekki 2007) [12]. Olaoye (2009) [20] observed on increase of up to 45.38 cm in plant height at 100% field capacity and decrease of up to 24.69 cm with decreasing field capacity. Water stress at grain filling stage significantly reduced the plant height of maize (Khoshvaghti *et al.,* 2013) [13].

The plant height significantly varied among the selected genotypes. Among the genotypes evaluated, mean plant height was significantly highest in CP-818 (199.05 cm) followed by ARJUN (197.85 cm) and lowest mean plant height was recorded in DMIL-150 (166.05 cm). Around 18 per cent reduction in the plant height under water stress condition was evident. The results are in accordance with Ameer *et al.,* (2009) [2], Lella (2011) [15], Ahsan *et al.,* (2011) [1] and Sunita *et al.,* (2012) [27] who also observed on differences among the genotypes in plant height under water stress conditions.

Leaf area development is an important factor that influences the response of the crop to water availability. The leaf number and area are considered as active photosynthetic sources that contribute to growth and formation of yield. Leaf blade area, number, angle, orientation and functional period, all contribute to leaf canopy structure and function. In the present investigation, Maximum number of leaves (10) was obtained in irrigated conditions as against the stress situation (12).

In general, water stress reduces the leaf area formation which causes yield loss by reducing the photosynthesis. The leaf area significantly varied among the irrigated and water stress situations and significant differences in the leaf area were noted among the selected genotypes. Mean leaf area was significantly higher in irrigated situation (57.03dm^2/plant) as compared to stress condition (42.62 dm^2/plant). Among the genotypes, mean leaf area was significantly higher in DMR-11 (61.08 dm^2/plant) followed by DMR-30 (60.99 dm^2/plant) and lowest was in DMIL-150 (34.95 dm^2/plant) and DMIL-051 (34.30 dm^2/plant).This may be attributed to the fact that the leaf area expansion depends on leaf turgor, temperature and assimilates supply for growth which is usually affected in drought situation. The results are in line with the findings of Cakir (2003) [5], and Zafar *et al.,* (2011) [29] who found that water stress significantly reduced the leaf number and area in maize.

Another most important morphological trait that has a greater contribution to the economic yield of the crop is dry matter accumulation and distribution. Dry matter production is basically a measure of plant photosynthetic efficiency, which is influenced by balance nutrient availability and environmental factors (Amin MEMH, 2011) [3]. Leaves are the major source of dry matter production through photosynthesis, and then accumulated into various plant parts through different physiological processes (Iqbal *et al.,* 2014) [9]. The dry matter production in cereals is highly depended on plant photosynthetic efficiency and the sink capacity to accumulate the photosynthates from the leaf (Warriach *et al.,* 2002) [28]. The balance nutrient provision increases the dry matter production into various plant parts through its impact on more leaf area production and high photosynthetic rates (Gasim 2001) [7]. The dry matter production highly influenced the plant biomass production and grain yield of the crop (Hocking 1997 and Plaut *et al.,* 2004) [8, 21].

Drought stress reduces the rate of dry matter production and it's partitioning thus affecting the kernel yield. Mean total dry matter was significantly higher in irrigated situation (356.863 g plant^{-1}) as compared to stress condition (215.08g plant^{-1}). Among the genotypes, mean total dry matter was significantly higher in DMR-30 (397.29 g plant^{-1}) followed by DMR-11 (385.98g plant^{-1}) and lowest was in DMIL-051 (155.88g plant^{-1}) and DMIL-150 (150.59 g plant^{-1}) respectively. The total dry matter reduced by 66 per cent under stress condition as against the irrigated condition. Similar results were reported by Khan *et al.,* (2001) [11] and Shiri *et al.,* (2010) [25]. Similarly, Shoukofar *et al.,* reported on 28-32 per cent decrease in the dry matter production in water stress conditions imposed at vegetative growth stage. Also, significant variation among the genotypes for total dry matter was evident from the present study. The high yielding genotype DMR-30 had maximum dry matter accumulation as compared to poor performing genotype DMIL-150. Similar results were obtained by Lella (2011) [15] who reported on 14-16 per cent variation among the in the dry matter production under terminal drought situation.

Drought is known to influence an array of bio physiological processes at the molecular, cellular, and whole plant levels, resulting in reduced maize growth and development. The Photosynthetic rate and stomatal conductance are important key elements in deciding the yield and productivity of the crop under water stress conditions. In the present study the photosynthetic rate and stomatal conductance was significantly reduced by the situation of stress which is a clear indication of stomatal closure. Around 31.25 per cent decrease in photosynthetic rate and 25 per cent decrease in the stomatal conductance under stress conditions was observed at 60 DAS. The observed reduction in photosynthesis is attributed to decreased availability and activity of CO_2 assimilating enzymes like ribulose-1, 5- bisphosphate carboxylase/oxygenase (RuBisCO). Photosynthesis is one of the key processes that are significantly affected by drought stress (Eberhard *et al.*,2008). Previous studies on drought tolerant maize have shown that they exhibit minimal plasticity in their leaf gas exchange characteristics and subsequently maintain higher rates of photosynthesis and stomatal conductance during periods of low drought stress (Efeoglu, *et al.*, 2009) [6]. The results are in conformity with Vyas *et al.*, (2001) who reported on a negative effect of water stress on growth, photosynthetic activity and yield of the plant. Also with the findings of Ghannoum (2009) who reported on reduced photosynthetic rate due to water stress accompanied by changes in leaf water potential.

In the present study significant variation among the genotypes in photosynthetic rate and stomatal conductance was observed under stress and irrigated conditions. The genotypes DMR 11 recorded higher values in photosynthetic rate and stomatal conductance (35.06 µ mol CO2 /m2/s and 0.616 µ mole/m2/s, respectively) closely followed by DMR-30 (34.29µ mol CO2 /m2/s and 0.618µ mole/m2/s at 60DAS and lowest in DMIL-051 (23.38 µ mol CO2 /m2/s and 0.469µ mole/m2/s) and DMIL-150 (23.01µ mol CO2 /m2/s and 0.464 µ mole/m2/s). Similar trend was observed by Moradi *et al.*, (2008) in mung bean.

Drought is known to affect morphology, photosynthesis, and dry matter accumulation as well as grain yield and the nutritional composition of maize (Çakir 2004). It is widely recognized that maize is sensitive to drought throughout the growing season, especially during its reproductive stages (Çakir 2004). Mean yield/ha was significantly higher in irrigated situation (93.35q/ha) as compared to stress condition (42.83 q/ha). Significant variations in yield were observed among the genotypes. Among the genotypes, mean yield/ha was significantly higher in DMR-30 (105.42q/ha) followed by DMR-11(101.64q/ha) and lowest was in DMIL-051 (31.81q/ha) and DMIL-150(26.15q/ha).Drought at flowering causes severe barrenness and destabilizes the grain yield. Ability of a genotype to produce reproductive apparatus under such adverse conditions is an important characteristic of drought tolerance in maize (Saeed *et al.*, 1997, Rashid 2004 and Monneveux *et al.*, 2006) [24, 22]. Drought stress during grain filling period primarily affects kernel weight due to decrease in leaf carbon exchange rates (Jurgens *et al.*, 1978) [10]. These results are in agreement with findings of Monneveux *et al.* (2008) [17], Mostafavi *et al.* (2011) [18], Shoukofar *et al.* (2011) [26] who also reported the greatest reduction in yield attributing traits under stress that resulted in reduction of grain yield compared to irrigated situations.

Table 1: Effect of moisture stress and irrigation on plant height (cm) and number of leaves under two different water regimes

Genotypes	Plant height (cm)			No. of leaves		
	Stress	Irrigated	Mean	Stress	Irrigated	Mean
SCH-08	174.9	192.4	183.7	10	11	11
CI-04	169.1	191.9	180.5	10	12	11
KDMI-16	172.9	194.0	183.5	9	13	11
F1-01	172.8	193.3	183.1	10	11	11
F1-08	169.6	191.0	180.3	11	14	13
F1-74	174.1	193.9	184.0	10	13	12
F1-119	172.6	192.6	182.6	10	13	12
F1-130	170.4	191.8	181.1	11	14	13
F1-135	172.0	191.9	182.0	12	12	12
F1-149	173.8	193.4	183.6	10	13	12
H-02	167.7	188.5	178.1	10	12	11
H-12	166.5	187.4	177.0	11	14	13
H-09	167.3	190.5	178.9	10	11	11
H-13	173.0	193.6	183.3	9	12	11
H-15	169.7	190.3	180.0	10	12	11
H-08	170.7	190.9	180.8	11	13	12
H-04	180.4	201.7	191.1	11	12	12
H-14	169.3	190.5	179.9	10	13	12
H-16	166.2	197.9	182.1	9	13	11
H-10	171.1	191.6	181.4	10	12	11
H-17	176.2	194.0	185.1	11	13	12
H-06	163.7	183.7	173.7	11	12	12
H-01	160.2	185.4	172.8	9	11	10
H-05	160.9	182.9	171.9	11	12	12
H-07	164.8	186.6	175.7	10	12	11
H-04	167.8	188.8	178.3	8	11	10
H-03	163.6	183.6	173.6	8	13	11
SCH-04	167.7	188.4	178.1	10	11	11

SCH-03	167.5	188.7	178.1	9	11	10
SCH-02	171.9	193.1	182.5	11	12	12
SCH-01	170.4	191.9	181.2	10	12	11
DMIL-150	155.2	176.9	166.1	10	11	11
DMIL-090	168.0	190.4	179.2	11	12	12
DMIL-061	161.2	182.9	172.1	10	13	12
DMIL-001	159.6	180.7	170.2	9	10	10
DMIL-147	161.2	182.9	172.1	11	13	12
DMIL-136	163.5	186.3	174.9	9	12	11
DMIL-051	158.5	180.3	169.4	8	9	9
DMIL-110	160.3	181.8	171.1	8	10	9
DMIL-149	167.5	192.9	180.2	10	12	11
DMIL-165	162.3	188.5	175.4	11	13	12
DMIL-008	172.5	192.3	182.4	10	12	11
DMIL-103	174.4	195.7	185.1	10	13	12
DMIL-031	164.4	185.8	175.1	10	12	11
DMIL-055	179.5	200.5	190.0	11	12	12
DMIL-749	160.0	182.2	171.1	11	13	12
DMIL-326	162.3	182.6	172.5	9	11	10
DMIL-122	162.0	184.4	173.2	10	11	11
PAC	170.3	190.4	180.4	10	13	12
HEMA	165.9	187.9	176.9	12	14	13
GH-0727	170.1	191.2	180.7	10	12	11
NITYASHREE	173.4	194.8	184.1	11	13	12
ARJUN	186.4	209.3	197.9	11	12	12
CP-818	187.9	210.2	199.1	12	12	12
BIO-9681	172.3	194.6	183.5	10	14	12
SUPER 900 M	174.5	196.4	185.5	11	14	13
DMR-2	170.4	190.6	180.5	8	11	10
DMR-4	169.6	192.5	181.1	9	10	10
DMR-8	167.0	188.5	177.8	8	11	10
DMR-3	172.5	192.6	182.6	10	10	10
DMR-1	170.8	205.8	188.3	9	12	11
DMR-5	179.1	201.2	190.2	9	10	10
DMR-7	171.3	191.8	181.6	9	9	9
DMR-10	169.8	188.4	179.1	10	10	10
DMR-36	164.6	187.0	175.8	9	11	10
DMR-32	183.4	205.1	194.3	8	10	9
DMR-27	170.2	190.3	180.3	11	11	11
DMR-21	172.5	193.8	183.2	10	13	12
DMR-23	163.0	202.9	183.0	11	12	12
DMR-22	166.7	187.9	177.3	10	11	11
DMR-18	165.1	187.1	176.1	11	12	12
DMR-13	174.3	193.5	183.9	9	10	10
DMR-28	174.0	194.7	184.4	11	13	12
DMR-15	173.2	193.3	183.3	10	12	11
DMR-20	171.3	191.7	181.5	11	12	12
DMR-12	174.6	194.7	184.7	10	12	11
DMR-24	174.0	193.9	184.0	9	11	10
DMR-19	172.2	194.1	183.2	8	10	9
DMR-11	185.3	208.5	196.9	10	10	10
DMR-31	169.3	189.4	179.4	8	10	9
DMR-29	168.7	189.7	179.2	9	11	10
DMR-35	171.0	192.1	181.6	11	13	12
DMR-30	171.0	191.8	181.4	10	11	11
DMR-33	171.2	194.4	182.8	11	13	12
DMR-38	183.4	205.1	194.3	9	10	10
DMR-37	170.0	190.6	180.3	8	10	9
DMR-41	178.0	198.9	188.5	10	12	11
DMR-45	185.1	207.9	196.5	9	10	10
DMR-44	169.8	191.8	180.8	11	9	10
DMR-43	173.4	197.8	185.6	8	9	9
DMR-49	167.0	188.4	177.7	8	11	10
DMR-39	163.0	185.2	174.1	11	12	12
GDH-101	172.5	190.0	181.3	9	13	11
GDH-102	169.9	189.3	179.6	10	12	11
GDH-103	177.0	198.7	187.9	9	12	11
GDH-104	170.3	190.7	180.5	10	13	12
GDH-105	169.6	187.7	178.7	11	12	12

GDH-106	166.6	188.3	177.5	10	12	11
ARBMH-07	178.3	199.1	188.7	11	12	12
SCH-05	165.0	188.2	176.6	10	13	12
SCH-06	167.3	189.9	178.6	10	12	11
SCH-07	164.3	184.7	174.5	9	13	11
HS-10	169.1	190.1	179.6	12	14	13
HS-07	167.7	188.4	178.1	11	13	12
HS-04	166.7	190.4	178.6	10	11	11
F1-148	165.6	188.0	176.8	14	13	14
F1-142	163.8	186.2	175.0	10	11	11
F1-121	164.9	185.4	175.2	10	11	11
F1-120	164.0	187.7	175.9	11	12	12
F1-119	166.6	189.9	178.3	12	12	12
F1-101	164.7	187.4	176.1	13	11	12
F1-100	167.0	188.1	177.6	10	11	11
F1-92	170.0	190.4	180.2	11	13	12
F1-78	170.4	191.3	180.9	13	12	13
F1-74	166.8	187.4	177.1	11	14	13
F1-68	165.5	186.0	175.8	9	11	10
F1-63	166.6	187.4	177.0	8	13	11
F1-62	164.5	188.4	176.5	10	13	12
F1-50	167.7	188.4	178.1	8	10	9
F1-46	167.0	189.2	178.1	10	12	11
F1-42	172.8	192.6	182.7	10	11	11
F1-39	171.2	191.9	181.6	10	13	12
F1-36	174.2	194.4	184.3	12	13	13
F1-24	168.2	190.6	179.4	10	14	12
F1-20	172.1	190.4	181.3	12	13	13
F1-19	169.3	189.2	179.3	10	14	12
SELF-30	166.6	187.3	177.0	11	13	12
SELF-29	172.2	190.5	181.4	10	13	12
SELF-28	167.3	188.6	178.0	10	12	11
SELF-26	172.2	193.6	182.9	10	14	12
SELF-25	168.9	192.0	180.5	10	13	12
SELF-23	175.4	195.9	185.7	10	13	12
SELF-21	165.0	187.6	176.3	10	12	11
SELF-20	171.3	191.3	181.3	13	14	14
SELF-19	168.0	188.8	178.4	9	11	10
SELF-18	170.5	191.2	180.9	12	13	13
SELF-17	169.8	190.3	180.1	10	12	11
SELF-14	164.3	186.2	175.3	11	12	12
SELF-13	168.0	188.9	178.5	10	11	11
SELF-12	162.3	184.1	173.2	9	11	10
SELF-11	163.8	186.5	175.2	10	13	12
SELF-10	167.1	189.7	178.4	11	13	12
SELF-09	160.3	182.6	171.5	8	11	10
SELF-08	161.1	182.9	172.0	12	12	12
SELF-06	162.9	182.4	172.7	12	11	12
SELF-05	163.7	185.8	174.8	11	13	12
SELF-04	161.8	184.8	173.3	13	11	12
SELF-03	166.5	187.3	176.9	12	12	12
SELF-02	172.8	191.7	182.3	11	11	11
SELF-01	169.4	188.8	179.1	11	12	12
Mean	169.2	190.8	180.0	10.1	11.9	11.0
Factors	SEm±	CD @ 5 %		SEm±	CD @ 5 %	
Stress	0.27	0.77		0.05	0.15	
Lines	2.38	6.62		0.46	1.28	
Stress * Lines	3.37	9.37		0.65	1.81	

Table 2: Effect of moisture stress and irrigation on and leaf dry Area (g plant^{-1}) and total dry matter under two different water regimes

Genotypes	Leaf Area (dm^{2}plant^{-1})			Total dry matter (g plant^{-1})		
	Stress	Irrigated	Mean	Stress	Irrigated	Mean
SCH-08	48.44	61.58	55.01	217.56	466.17	341.86
CI-04	43.47	57.94	50.71	239.91	348.16	294.03
KDMI-16	50.66	58.92	54.79	276.97	395.69	336.33
F1-01	47.71	60.27	53.99	282.22	378.44	330.33
F1-08	42.07	58.56	50.32	249.04	332.03	290.53
F1-74	48.19	62.28	55.24	261.55	424.72	343.13

F1-119	40.49	66.71	53.60	302.98	351.86	327.42
F1-130	42.18	60.55	51.37	209.14	393.98	301.56
F1-135	41.23	64.78	53.01	267.57	365.99	316.78
F1-149	49.24	60.59	54.92	278.8	402.41	340.60
H-02	43.38	53.26	48.32	253.67	287.82	270.74
H-12	40.13	54.29	47.21	173.04	348.21	260.62
H-09	43.13	54.43	48.78	191.86	364.22	278.04
H-13	53.55	55.95	54.75	278.01	392.73	335.37
H-15	46.23	53.33	49.78	213.83	349.59	281.71
H-08	38.90	63.14	51.02	223.39	370.47	296.93
H-04	47.23	68.04	57.64	324.62	412.29	368.45
H-14	42.54	57.01	49.78	184.18	378.99	281.58
H-16	44.18	61.84	53.01	294.45	342.39	318.42
H-10	45.49	58.76	52.13	223.31	388.58	305.94
H-17	42.31	71.08	56.70	301.85	395.03	348.44
H-06	40.23	46.23	43.23	131.3	306.45	218.87
H-01	39.26	43.72	41.49	107.21	288.32	197.76
H-05	34.38	45.66	40.02	171.77	191.92	181.84
H-07	42.62	49.21	45.92	187.85	307.3	247.57
H-04	44.82	52.32	48.57	185.08	365.17	275.12
H-03	33.52	51.29	42.41	117.25	315.04	216.14
SCH-04	38.19	58.35	48.27	143.84	395.13	269.48
SCH-03	46.75	49.89	48.32	220.45	324	272.22
SCH-02	44.03	62.18	53.11	294.04	346.09	320.06
SCH-01	45.36	58.00	51.68	275.22	328.18	301.70
DMIL-150	29.10	40.80	34.95	127.58	173.6	150.59
DMIL-090	41.61	57.00	49.31	235.73	322.58	279.15
DMIL-061	40.03	41.95	40.99	163.24	218.83	191.03
DMIL-001	32.78	41.84	37.31	72.73	247.93	160.33
DMIL-147	38.24	43.34	40.79	147.43	230.44	188.93
DMIL-136	43.16	46.62	44.89	113.11	365.83	239.47
DMIL-051	22.41	46.20	34.31	153.05	158.71	155.88
DMIL-110	30.38	45.98	38.18	114.99	229.92	172.45
DMIL-149	47.02	53.25	50.14	186.17	387.05	286.61
DMIL-165	36.52	55.30	45.91	182.51	312.14	247.32
DMIL-008	48.07	58.13	53.10	263.71	373.92	318.81
DMIL-103	45.01	68.05	56.53	284.33	412.19	348.26
DMIL-031	33.34	56.77	45.06	131.79	351.35	241.57
DMIL-055	50.23	64.54	57.39	318.56	410.88	364.72
DMIL-749	29.29	48.78	39.04	164.75	190.42	177.58
DMIL-326	31.30	51.18	41.24	181.64	200.62	191.13
DMIL-122	34.22	48.82	41.52	151.55	268.82	210.18
PAC	45.60	55.30	50.45	233.37	350.9	292.13
HEMA	36.19	58.22	47.21	178.61	342.21	260.41
GH-0727	48.31	53.38	50.85	190.53	400.48	295.50
NITYASHREE	48.55	63.01	55.78	215.45	471.53	343.49
ARJUN	47.53	57.73	52.63	175.11	440.48	307.79
CP-818	51.63	65.63	58.63	374.54	393.15	383.84
BIO-9681	52.72	56.98	54.85	288.41	389.55	338.98
SUPER 900 M	54.93	58.89	56.91	289.72	409.71	349.71
DMR-2	41.44	60.23	50.84	173	415.89	294.44
DMR-4	44.92	57.54	51.23	230.67	367.35	299.01
DMR-8	43.07	53.24	48.16	169.89	366.15	268.02
DMR-3	47.56	59.14	53.35	251.04	401	326.02
DMR-1	49.33	65.08	57.21	264.66	455.51	360.08
DMR-5	52.92	62.00	57.46	332.37	404.21	368.29
DMR-7	41.11	64.46	52.79	237.22	382.96	310.09
DMR-10	44.13	51.68	48.91	159.63	398.25	278.94
DMR-36	41.38	50.74	46.06	168.41	332.47	250.44
DMR-32	55.62	61.14	58.38	309.77	428.87	369.32
DMR-27	43.69	56.65	50.17	231.47	342.75	287.11
DMR-21	50.11	58.26	54.19	298.78	367.04	332.91
DMR-23	49.00	58.98	53.99	278.39	381.4	329.89
DMR-22	35.66	60.16	47.91	165.3	364.8	265.05
DMR-18	41.01	52.14	46.58	192.36	313.41	252.88
DMR-13	46.01	64.02	55.02	238.03	446.29	342.16
DMR-28	43.33	68.78	56.06	288.87	401.54	345.20
DMR-15	42.73	66.26	54.50	276.32	393.98	335.15
DMR-20	46.98	58.53	52.76	239.13	377.76	308.44

DMR-12	47.11	65.55	56.33	315.65	376.67	346.16
DMR-24	48.92	61.19	55.06	275.71	410.08	342.89
DMR-19	49.03	59.10	54.07	194.73	468.87	331.80
DMR-11	53.13	69.03	61.08	278.72	493.23	385.97
DMR-31	41.34	57.56	49.45	201.35	358.96	280.15
DMR-29	39.13	58.69	48.91	202.04	356.16	279.10
DMR-35	45.80	59.81	52.81	226.07	394.95	310.50
DMR-30	48.40	73.59	61.00	339.21	455.37	397.29
DMR-33	42.32	65.33	53.83	234.52	421.46	327.99
DMR-38	48.04	70.86	59.45	270.67	468.89	369.78
DMR-37	43.23	57.35	50.29	223.88	351.91	287.89
DMR-41	50.15	64.31	57.23	306.06	419.03	362.54
DMR-45	47.99	69.59	58.79	320.68	429.89	375.28
DMR-44	44.14	57.90	51.02	165.03	426.45	295.74
DMR-43	44.00	69.89	56.95	266.77	433.87	350.32
DMR-49	33.88	62.40	48.14	156.11	379.32	267.71
DMR-39	30.56	57.73	44.15	107.17	352.92	230.04
GDH-101	49.68	54.34	52.01	223.69	382.27	302.98
GDH-102	41.92	57.57	49.75	190.54	371.72	281.13
GDH-103	51.73	62.30	57.02	270.12	437.65	353.88
GDH-104	41.36	60.01	50.69	261.6	324.08	292.84
GDH-105	49.77	47.74	48.76	227.8	327.15	277.47
GDH-106	41.20	54.76	47.98	161.25	370.57	265.91
ARBMH-07	42.08	72.50	57.29	312.2	416.09	364.14
SCH-05	39.54	54.18	46.86	171.82	337.61	254.71
SCH-06	42.43	55.00	48.72	253.48	300.35	276.91
SCH-07	33.67	55.00	44.34	174.48	297.84	236.16
HS-10	38.20	61.19	49.70	154.72	406.47	280.59
HS-07	39.42	57.17	48.30	152.85	388.22	270.53
HS-04	42.38	55.00	48.69	220.41	333.35	276.88
F1-148	37.09	56.98	47.04	155.62	356.73	256.17
F1-142	34.03	56.07	45.05	138	341.61	239.80
F1-121	42.34	47.98	45.16	154.01	333.91	243.96
F1-120	44.88	47.62	46.25	128.92	376.16	252.54
F1-119	42.87	54.15	48.51	215.9	331.85	273.87
F1-101	39.15	53.45	46.30	158.84	346.38	252.61
F1-100	42.66	53.40	48.03	215.69	319.22	267.45
F1-92	39.35	60.65	50.00	294.59	271.91	283.25
F1-78	47.03	55.08	51.06	248.36	347.8	298.08
F1-74	46.37	48.83	47.60	161.88	365.32	263.60
F1-68	41.33	50.78	46.06	209.33	291.3	250.31
F1-63	42.65	52.24	47.45	159.06	367.65	263.35
F1-62	41.88	51.63	46.76	197.79	309.5	253.64
F1-50	39.13	57.43	48.28	181	358.71	269.85
F1-46	34.75	62.25	48.50	211.01	336.43	273.72
F1-42	48.16	59.08	53.62	218.88	436.24	327.56
F1-39	40.16	65.80	52.98	209.38	423.33	316.35
F1-36	46.88	65.00	55.94	350.12	340.12	345.12
F1-24	42.16	57.14	49.65	165.83	394.74	280.28
F1-20	43.19	60.24	51.72	266.24	338.17	302.20
F1-19	40.00	58.71	49.36	151.79	406.93	279.36
SELF-30	35.72	58.99	47.36	209.11	316.62	262.86
SELF-29	45.00	59.39	52.20	230.32	385.09	307.70
SELF-28	43.02	53.43	48.23	132.38	406.53	269.45
SELF-26	46.53	61.36	53.95	242.34	415.77	329.05
SELF-25	44.48	56.60	50.54	174.75	410.38	292.56
SELF-23	50.98	62.94	56.96	230.31	474.81	352.56
SELF-21	43.00	50.23	46.62	234.95	271.07	253.01
SELF-20	43.44	60.76	52.10	201.45	407.17	304.31
SELF-19	36.38	60.89	48.64	212.4	340.52	276.46
SELF-18	46.22	55.85	51.04	232.99	362.82	297.90
SELF-17	42.07	57.72	49.90	219.09	346.41	282.75
SELF-14	32.90	58.88	45.89	185.47	305.2	245.33
SELF-13	40.47	56.81	48.64	212.23	340.94	276.58
SELF-12	39.17	44.88	42.03	147.74	277.58	212.66
SELF-11	41.17	50.38	45.78	224.18	266.22	245.20
SELF-10	46.77	50.44	48.61	222.8	329.87	276.33
SELF-09	31.55	46.98	39.27	171.43	185.65	178.54
SELF-08	35.10	46.02	40.56	121.55	252.47	187.01

SELF-06	34.56	48.11	41.34	153.56	234.23	193.89
SELF-05	32.38	56.93	44.66	127.82	350.54	239.18
SELF-04	40.38	43.76	42.07	149.18	282.97	216.07
SELF-03	42.28	52.00	47.14	219.46	296.85	258.15
SELF-02	45.52	55.03	51.78	237.46	367.61	302.53
SELF-01	39.32	58.48	48.90	191.71	364.52	278.11
Mean	42.62	57.03	49.84	215.08	356.86	285.97
Factors	SEm±	CD @ 5 %		SEm±	CD @ 5 %	
Stress	0.3	0.8		2.71	7.53	
Lines	2.5	6.9		23.44	65.23	
Stress * Lines	3.5	9.7		33.15	92.25	

Table 3: Effect of moisture stress and irrigation on Photosynthetic rate (µ mol CO_2 /m2/s), Stomatal conductance (µ mole/m2/s) and Grain yield (q/ha) under two different water regimes

Genotypes	Photosynthetic rate (µ mol CO2 /m2/s)			Stomatal conductance (µ mole/m2/s)			Grain Yield (q/ha)		
	Stress	**Irrigated**	**Mean**	**Stress**	**Irrigated**	**Mean**	**Stress**	**Irrigated**	**Mean**
SCH-08	9.75	15.96	12.86	0.359	0.484	0.422	52.30	115.39	83.85
CI-04	7.83	16.02	11.93	0.348	0.451	0.400	35.05	103.53	69.29
KDMI-16	9.11	16.57	12.84	0.381	0.459	0.420	62.55	104.61	83.58
F1-01	9.40	16.07	12.74	0.372	0.461	0.417	60.39	99.75	80.07
F1-08	7.65	16.05	11.85	0.351	0.442	0.397	43.68	93.28	68.48
F1-74	10.42	15.41	12.92	0.375	0.472	0.424	43.68	128.87	86.27
F1-119	8.64	16.43	12.54	0.363	0.461	0.412	55.54	100.83	78.19
F1-130	8.09	16.17	12.13	0.325	0.482	0.404	38.82	104.07	71.45
F1-135	9.42	15.46	12.44	0.369	0.452	0.411	56.62	95.44	76.03
F1-149	10.03	15.67	12.85	0.381	0.461	0.421	60.39	107.30	83.85
H-02	8.51	14.31	11.41	0.342	0.432	0.387	25.34	100.29	62.82
H-12	9.41	12.84	11.13	0.342	0.423	0.383	21.03	99.22	60.12
H-09	7.81	15.44	11.63	0.333	0.449	0.391	25.34	103.53	64.44
H-13	9.41	16.20	12.81	0.368	0.472	0.420	41.52	123.48	82.50
H-15	8.61	15.02	11.82	0.366	0.424	0.395	22.11	112.16	67.13
H-08	8.82	15.34	12.08	0.362	0.439	0.401	27.50	113.24	70.37
H-04	11.21	16.12	13.67	0.402	0.476	0.439	56.08	132.65	94.36
H-14	9.15	14.44	11.80	0.318	0.471	0.395	36.67	97.60	67.13
H-16	9.20	15.78	12.49	0.349	0.472	0.411	30.74	121.86	76.30
H-10	9.11	15.35	12.23	0.329	0.484	0.407	33.43	115.39	74.41
H-17	9.64	16.51	13.08	0.371	0.484	0.428	38.28	136.96	87.62
H-06	8.71	11.74	10.23	0.327	0.412	0.370	21.57	76.57	49.07
H-01	8.04	11.33	9.69	0.306	0.421	0.364	20.49	65.25	42.87
H-05	6.81	11.85	9.33	0.299	0.421	0.360	28.04	47.99	38.01
H-07	6.87	14.80	10.84	0.315	0.439	0.377	40.98	71.18	56.08
H-04	7.78	15.12	11.45	0.342	0.434	0.388	39.90	87.35	63.63
H-03	6.79	13.28	10.04	0.326	0.413	0.370	19.41	76.03	47.72
SCH-04	8.64	14.01	11.33	0.319	0.453	0.386	41.52	83.04	62.28
SCH-03	8.06	14.77	11.42	0.351	0.423	0.387	51.76	74.41	63.09
SCH-02	8.93	16.09	12.51	0.371	0.451	0.411	39.36	117.01	78.19
SCH-01	10.20	14.11	12.16	0.371	0.439	0.405	48.53	95.44	71.99
DMIL-150	5.61	9.13	7.37	0.293	0.394	0.344	12.40	39.90	26.15
DMIL-090	8.17	15.15	11.66	0.342	0.443	0.393	36.67	93.82	65.25
DMIL-061	7.79	11.25	9.52	0.307	0.417	0.362	25.34	55.00	40.17
DMIL-001	6.99	9.74	8.37	0.304	0.399	0.352	4.85	59.31	32.08
DMIL-147	7.66	11.24	9.45	0.318	0.405	0.362	28.04	51.23	39.63
DMIL-136	9.00	11.98	10.49	0.306	0.441	0.374	22.11	86.81	54.46
DMIL-051	4.31	11.64	7.98	0.291	0.412	0.352	21.03	42.60	31.81
DMIL-110	7.99	9.87	8.93	0.296	0.412	0.354	17.79	52.30	35.05
DMIL-149	7.57	16.11	11.84	0.338	0.453	0.396	44.75	90.05	67.40
DMIL-165	8.08	13.57	10.83	0.331	0.421	0.376	28.04	84.12	56.08
DMIL-008	8.91	16.09	12.50	0.371	0.451	0.411	31.81	124.02	77.92
DMIL-103	11.29	14.86	13.08	0.412	0.442	0.427	48.53	126.72	87.62
DMIL-031	8.64	12.68	10.66	0.329	0.421	0.375	35.05	75.49	55.27
DMIL-055	10.83	16.17	13.50	0.392	0.481	0.437	78.19	110.00	94.09
DMIL-749	6.07	12.18	9.13	0.294	0.416	0.355	27.50	47.45	37.48
DMIL-326	7.79	11.41	9.60	0.314	0.412	0.363	31.27	51.23	41.25
DMIL-122	7.32	12.24	9.78	0.324	0.404	0.364	22.65	67.94	45.29
PAC	9.31	14.47	11.89	0.332	0.462	0.397	46.91	90.05	68.48
HEMA	6.77	15.29	11.03	0.342	0.422	0.382	33.43	86.81	60.12
GH-0727	7.76	16.15	11.96	0.352	0.448	0.400	57.16	83.04	70.10
NITYASHREE	9.91	16.12	13.02	0.369	0.481	0.425	59.85	113.24	86.54
ARJUN	8.72	15.95	12.34	0.353	0.461	0.407	55.54	94.36	74.95

CP-818	11.84	16.65	14.25	0.431	0.472	0.452	58.24	140.74	99.49
BIO-9681	8.91	16.78	12.85	0.389	0.452	0.421	58.77	108.92	83.85
SUPER 900 M	10.01	16.15	13.08	0.371	0.487	0.429	39.36	136.42	87.89
DMR-2	8.41	15.49	11.95	0.349	0.451	0.400	44.75	95.44	70.10
DMR-4	8.92	15.33	12.13	0.344	0.462	0.403	53.92	87.89	70.91
DMR-8	8.64	13.87	11.26	0.317	0.452	0.385	26.96	96.52	61.74
DMR-3	9.73	15.31	12.52	0.341	0.482	0.412	45.83	110.54	78.19
DMR-1	11.00	15.62	13.31	0.382	0.481	0.432	69.56	113.77	91.67
DMR-5	11.13	16.14	13.64	0.396	0.481	0.439	76.57	112.16	94.36
DMR-7	8.46	16.31	12.39	0.345	0.471	0.408	52.84	97.60	75.22
DMR-10	7.63	15.68	11.66	0.311	0.473	0.392	42.60	86.81	64.71
DMR-36	9.37	12.35	10.86	0.343	0.413	0.378	22.65	90.05	56.35
DMR-32	11.18	16.36	13.77	0.411	0.473	0.442	56.62	134.80	95.71
DMR-27	8.41	15.28	11.85	0.321	0.471	0.396	53.38	81.96	67.67
DMR-21	8.42	17.15	12.79	0.349	0.487	0.418	49.07	113.77	81.42
DMR-23	9.73	15.73	12.73	0.371	0.461	0.416	56.08	104.07	80.07
DMR-22	10.32	12.05	11.19	0.345	0.423	0.384	41.52	80.34	60.93
DMR-18	7.09	14.73	10.91	0.325	0.432	0.379	36.67	78.73	57.70
DMR-13	9.47	16.32	12.90	0.365	0.480	0.423	57.16	112.16	84.66
DMR-28	10.02	16.07	13.05	0.381	0.472	0.427	74.41	99.75	87.08
DMR-15	9.91	15.70	12.81	0.371	0.468	0.420	62.01	100.83	81.42
DMR-20	9.13	15.58	12.36	0.383	0.432	0.408	63.63	86.81	75.22
DMR-12	10.12	15.98	13.05	0.382	0.471	0.427	84.66	90.05	87.35
DMR-24	10.10	15.71	12.91	0.373	0.473	0.423	78.19	91.67	84.93
DMR-19	9.31	16.16	12.74	0.340	0.494	0.417	65.78	95.98	80.88
DMR-11	12.71	16.05	14.38	0.442	0.471	0.457	97.06	106.23	101.64
DMR-31	7.95	15.54	11.75	0.368	0.418	0.393	25.88	106.23	66.05
DMR-29	7.17	16.14	11.66	0.314	0.471	0.393	64.17	65.78	64.98
DMR-35	8.77	16.02	12.40	0.378	0.439	0.409	44.75	106.23	75.49
DMR-30	12.62	15.62	14.12	0.431	0.487	0.459	79.80	131.03	105.42
DMR-33	8.72	16.62	12.67	0.345	0.485	0.415	57.16	100.83	79.00
DMR-38	11.71	16.09	13.90	0.402	0.482	0.442	94.90	99.75	97.33
DMR-37	9.94	13.75	11.85	0.370	0.423	0.397	24.80	112.16	68.48
DMR-41	9.77	16.93	13.35	0.373	0.495	0.434	72.25	114.85	93.55
DMR-45	9.97	17.87	13.92	0.441	0.458	0.450	76.03	120.25	98.14
DMR-44	8.18	15.84	12.01	0.373	0.427	0.400	50.15	90.05	70.10
DMR-43	10.19	16.25	13.22	0.401	0.458	0.430	63.63	115.93	89.78
DMR-49	7.64	14.82	11.23	0.327	0.442	0.385	51.76	71.72	61.74
DMR-39	7.14	13.40	10.27	0.306	0.438	0.372	32.35	73.33	52.84
GDH-101	8.42	15.97	12.20	0.361	0.451	0.406	43.68	104.07	73.87
GDH-102	8.94	14.62	11.78	0.339	0.449	0.394	40.98	92.75	66.86
GDH-103	9.76	16.72	13.24	0.371	0.490	0.431	55.00	125.64	90.32
GDH-104	8.74	15.10	11.92	0.319	0.479	0.399	34.51	103.53	69.02
GDH-105	8.29	14.89	11.59	0.341	0.439	0.390	36.67	92.21	64.44
GDH-106	8.63	13.81	11.22	0.324	0.444	0.384	29.12	93.28	61.20
ARBMH-07	10.83	16.17	13.50	0.432	0.441	0.437	74.95	112.70	93.82
SCH-05	7.93	14.04	10.99	0.342	0.418	0.380	30.74	86.27	58.50
SCH-06	9.47	13.64	11.56	0.332	0.448	0.390	29.66	98.68	64.17
SCH-07	8.48	12.11	10.30	0.303	0.442	0.373	39.90	66.32	53.11
HS-10	8.89	14.63	11.76	0.368	0.419	0.394	50.69	82.50	66.59
HS-07	9.31	13.48	11.40	0.342	0.431	0.387	42.06	83.58	62.82
HS-04	7.64	15.43	11.54	0.342	0.438	0.390	34.51	93.82	64.17
F1-148	7.64	14.39	11.02	0.341	0.421	0.381	26.96	91.13	59.04
F1-142	8.61	12.44	10.53	0.297	0.451	0.374	34.51	76.03	55.27
F1-121	8.26	13.11	10.69	0.331	0.419	0.375	21.03	90.59	55.81
F1-120	7.19	14.54	10.87	0.324	0.432	0.378	47.45	65.78	56.62
F1-119	8.61	14.27	11.44	0.333	0.443	0.388	44.75	82.50	63.63
F1-101	8.31	13.45	10.88	0.341	0.415	0.378	26.96	88.43	57.70
F1-100	8.77	13.68	11.23	0.331	0.437	0.384	31.81	90.59	61.20
F1-92	8.41	15.25	11.83	0.345	0.446	0.396	29.12	105.69	67.40
F1-78	9.09	15.14	12.12	0.365	0.440	0.403	47.99	93.82	70.91
F1-74	8.12	14.18	11.15	0.319	0.448	0.384	51.23	70.64	60.93
F1-68	7.78	13.91	10.85	0.333	0.421	0.377	18.33	94.36	56.35
F1-63	8.67	13.60	11.14	0.351	0.415	0.383	25.88	95.98	60.93
F1-62	9.40	12.54	10.97	0.342	0.418	0.380	29.66	86.27	57.97
F1-50	7.07	15.60	11.34	0.321	0.452	0.387	28.58	97.06	62.82
F1-46	8.71	14.15	11.43	0.314	0.461	0.388	28.04	98.68	63.36
F1-42	9.84	15.36	12.60	0.342	0.483	0.413	46.91	110.00	78.46
F1-39	9.10	15.77	12.44	0.349	0.472	0.411	49.07	102.45	75.76

F1-36	9.99	16.09	13.04	0.371	0.482	0.427	55.00	119.17	87.08
F1-24	7.62	15.89	11.76	0.368	0.418	0.393	38.28	94.36	66.32
F1-20	8.13	16.18	12.16	0.341	0.469	0.405	32.35	114.85	73.60
F1-19	8.42	15.05	11.74	0.365	0.421	0.393	38.82	93.28	66.05
SELF-30	8.62	13.64	11.13	0.314	0.452	0.383	28.04	93.82	60.93
SELF-29	8.06	16.47	12.27	0.361	0.453	0.407	48.53	101.37	74.95
SELF-28	8.95	13.58	11.27	0.342	0.428	0.385	42.60	81.96	62.28
SELF-26	8.43	16.98	12.71	0.341	0.491	0.416	51.76	108.38	80.07
SELF-25	9.47	14.37	11.92	0.332	0.462	0.397	49.07	88.97	69.02
SELF-23	11.93	14.51	13.22	0.381	0.479	0.430	45.83	134.80	90.32
SELF-21	8.42	13.51	10.97	0.316	0.442	0.379	42.06	73.33	57.70
SELF-20	8.01	16.39	12.20	0.331	0.481	0.406	49.07	99.22	74.14
SELF-19	7.63	15.38	11.51	0.324	0.453	0.389	40.44	87.35	63.90
SELF-18	8.27	15.90	12.09	0.386	0.415	0.401	46.91	94.90	70.91
SELF-17	7.63	16.02	11.83	0.348	0.442	0.395	27.50	107.30	67.40
SELF-14	7.16	14.25	10.71	0.320	0.431	0.376	21.57	90.59	56.08
SELF-13	9.31	13.71	11.51	0.306	0.473	0.390	47.45	80.88	64.17
SELF-12	7.45	12.16	9.81	0.321	0.411	0.366	31.27	59.85	45.56
SELF-11	8.15	13.24	10.70	0.332	0.419	0.376	32.35	79.80	56.08
SELF-10	7.91	15.08	11.50	0.314	0.462	0.388	42.06	85.74	63.90
SELF-09	6.72	11.54	9.13	0.301	0.415	0.358	23.73	52.30	38.01
SELF-08	7.37	11.51	9.44	0.309	0.412	0.361	30.74	47.45	39.09
SELF-06	7.62	11.59	9.61	0.311	0.416	0.364	17.79	67.40	42.60
SELF-05	8.10	12.80	10.45	0.305	0.442	0.374	43.68	63.63	53.65
SELF-04	8.02	11.69	9.86	0.321	0.412	0.367	24.80	67.40	46.10
SELF-03	7.99	14.05	11.02	0.305	0.458	0.382	39.36	79.80	59.58
SELF-02	9.99	14.33	12.16	0.330	0.481	0.406	59.31	87.89	73.60
SELF-01	7.78	15.51	11.65	0.341	0.443	0.392	50.15	79.26	64.71
Mean	8.74	14.67	11.70	0.347	0.448	0.397	42.83	93.35	68.09
Factors	S.Em±	CD @ 5 %		S.Em±	CD @ 5 %		S.Em±	CD @ 5 %	
Stress	0.07	0.19		0.001	0.004		0.845	2.353	
Lines	0.59	1.64		0.012	0.034		7.322	20.378	
Stress * Lines	0.84	2.32		0.017	0.048		10.355	28.819	

Conclusion

Abiotic stress signalling is an important area with respect to increase in plant productivity. Drought stress affected the growth, dry mater and harvestable yield in plants. In conclusion, plant height, dry matter accumulation, photosynthetic rate, stomatal conductance and yield considerably reduced under water deficit conditions in all maize cultivars. Of all the genotypes evaluated the genotypes DMR-11 was categorized as tolerant and DMIL-150 as susceptible based on the performance.

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