Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2582-2845.8460

ISSN: 2582 – 2845

Ind. J. Pure App. Biosci. (2020) *8*(6), 350-358

Indian Journal of Pure & Applied Biosciences

Peer-Reviewed, Refereed, Open Access Journal

Research Article

Drought Tolerance of Maize Genotypes for Yield and Yield Parameters Using Line Source Sprinkler Irrigation Technique

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Received: 3.11.2020 | Revised: 7.12.2020 | Accepted: 12.12.2020

ABSTRACT

Forty maize genotypes were studied for influence of moisture stress on yield and yield characters using line source sprinkler irrigation technique during rabi-summer, 2016-17 and 2017-2018 using line source sprinkler irrigation technique. The genotypes, G32-DMIL 50, G16-DMIL 13, G39- DMIDS 28, G4-DMIL 78, G28-DMIT 01, G38-DMIDS 15, G15-DMIL 23, G21-DMIL 47, G24-DMIL 84 and G37-DMIDS recorded higher yield compared to other genotypes. The genotype G32- DMIL 50 found promising under various moisture regimes. The genotype G32-DMIL 50 (96.50) and G16- DMIL 13 (91.80) recorded significantly higher cob weight (g/cob) at M_1 moisture regime whereas, significantly lower cob weight (g/cob) was recorded in genotype G6- DMIT 30 (17.82), G12- DMIL 58 (18.45), G5- DMIL 150 (19.42), G19- DMID 16 (20.75), G7- DMIL 112 (22.15) and G17- DMIL 52 (22.23) at M_5 moisture regime. G21- DMIL 47 (315.89), G28- DMIT 01 (314.83) and G24- DMIL 84 (311.70) recorded significantly higher number of seeds per cob and G6- DMIT 30 (96.67) and G19- DMID 16 (116.05) recorded significantly lower number of seeds per cob. Genotypes G12- DMIL 58 (87.30), G38- DMIDS 15 (85.01), G39- DMIDS 28 (84.99), G26- DMIL 63 (84.80), G24- DMIL 84 (83.83) and G4- DMIL 78 (83.44) recorded significantly higher shelling percentage.

Key words: *Maize, Drought tolerance, Yield, Yield parameters, Moisture stress.*

INTRODUCTION

Maize (*Zea mays* L.) being a C_4 plant belongs to family *Poaceae* and is popularly known as "Queen of cereals" because of its high production potential and wider adoptability. Maize is the important cereal crop occupying 144 m ha area with a production of 695 mt in the world. In India, it is grown in an area of 8.26 m ha with a production of 19.31 mt (Anonymous, 2019). The productivity of maize in India is very low (2337 kg/ha) compared to the world average (4815 kg / ha). This is because nearly 79 per cent of the maize area is under rainfed situation, where the crop experiences soil moisture stress which leads to decreased yield.

Cite this article: Herakal, R.S., Channappagoudar, B.B., Navalagatti, C.M., Patil, B. R., & Patil, R.H. (2020). Drought Tolerance of Maize Genotypes for Yield and Yield Parameters Using Line Source Sprinkler Irrigation Technique, *Ind. J. Pure App. Biosci.* *8*(6), 350-358. doi: http://dx.doi.org/10.18782/2582-2845.8460

In Karnataka, the crop is grown in 1.17 m ha area with a production and productivity of 3.58 m t and 3060 kg/ha, respectively (Anonymous, 2019). About 42 per cent of the maize area is under irrigation and 58 per cent of the area is under rainfed situation in Karnataka.

MATERIALS AND METHODS

The line source sprinkler irrigation technique was laid out following the method developed by Hanks et al. (1976) in Main Agricultural Research Station, Dharwad, which is situated in agro-ecological northern transition zone (Zone 8) of Karnataka. Soil was red sandy loam in texture containing 5.50% coarse sand, 11.00% fine sand, 29.20% silt and 54.30% clay with PH of 7.65. The field experiment was conducted with 40 genotypes of maize. The seeds were sown in furrows by dibbling at a distance of 60 cm between the rows and 20 cm between the plants across the line source layout. Two to three seeds were dibbled per hill. At the time of dibbling care was taken to place the seeds at uniform depth. Thinning was done to retain one seedling per hill at 15 days after sowing. Recommended dose of fertilizer for irrigated condition 150:75:37.5 kg N: P: K per ha was applied. In moisture stress situation the entire dose of recommended fertilizer was applied as basal dose. While in case of irrigated condition the 50% of recommended dose of fertilizer and entire dose P_2O_5 and K_2O were applied as a basal dose. The remaining 50% of N was applied in two splits at 30 and 60 DAS. The field was irrigated through line source kept at 7.5 m interval daily to provide uniform irrigation to the plot up to 20 days after sowing. The treatment of water gradient levels was imposed on 21st day after sowing. Plant protection against pest and diseases was provided as per the package of practices and crop was maintained weed free throughout the season. Each genotype was raised in a two row of 7.5m length with a spacing of 60cm x 20 cm perpendicular to the line source on either side of the LS system with randomization. Each row was divided into 5 parts (M_1, M_2, M_3, M_4 and M_5 moisture regimes) each of 1.4m length which consisted of 7 plants. The water catch cans were placed perpendicular to LS system between rows in the middle of each part (moisture level) in line with sprinkler heads to estimate receipt of moisture levels. The water applied to each subplot was determined by measuring the water collected in plastic container (catch can) in different subplots at convenient locations (Fig 1).

The water collected in each plastic container is computed using

$$\text{Water applied (cm)} = \frac{\text{Water collected in each plastic container in } M_1 \text{ (cm}^3\text{)}}{\text{Area of the plastic container (cm}^2\text{)}}$$

The amount of water applied to each subplot is accumulated over the duration of the treatment. Any rainfall during the imposition of drought treatments is added to water input to all subplots (Table 1).

Water deficit thus created was calculated relative to the open pan evaporation that occurs during the treatment period.

Water deficit created relative to the open pan evaporation that occurred during the treatment period was calculated using the formula.

$$\text{Water deficit (\%)} = \frac{X_1 - X_2}{X_1} \times 100$$

Where,

X_1 = Cumulative open pan evaporation during the experimental period (cm)

X_2 = Cumulative amount of water applied (including rain) during the experimental period (cm)

RESULTS AND DISCUSSION

Grain yield (kg/ha)

Among the moisture regimes, M_1 recorded significantly higher values for maize yields followed by M_2, M_3 and M_4 and these treatments differed significantly among themselves. The treatment M_5 recorded significantly lower maize yield compared to other treatments.

Irrespective of moisture regimes and genotypes G32- DMIL 50 (4764) recorded the highest yield (kg/ha) and lowest yield (kg/ha) was observed in G2- DMIL 29 (1038) (Table 2). The interaction effects between moisture regimes and genotypes were significant. The genotype G32- DMIL 50 (6626), G16- DMIL 13 (6113) and G39- DMIDS 28 (5900) recorded significantly higher yield (kg/ha) at M_1 moisture regime and significantly lower yield (kg/ha) was recorded in genotype G2- DMIL 29 (559), G6- DMIT 30 (1202), G23- DMID 05 (1205) and G25- DMIL 99 (1314) at M5 moisture regime. At M_5 moisture regime genotype G32- DMIL 50 (2518), G16- DMIL 13 (2354), G39- DMIDS 28 (2289), G38- DMIDS 15 (2251), G15- DMIL 23 (2244) and G4- DMIL 78 (2209) recorded significantly higher yield (kg/ha) compared to other genotypes.

Cob weight (g/cob)

Water stress during grain filling period primarily affects kernel weight due to decrease in leaf carbon exchange rates (Jurgens et al., 1978). The reduced yield under water stress could be due to reduced grain number, kernel weight and cob length (Hall et al., 1981; Coasta et al., 1988; Subba Rao, 1992 & Vinodkumar, 1996). Irrespective of moisture regimes and genotypes G32- DMIL 50 (69.38) recorded significantly higher cob weight (g/cob) followed by G16- DMIL 13 (66.10) and G15- DMIL 23 (64.78) and significantly lower cob weight (g/cob) was observed G6- DMIT 30 (33.04), G12- DMIL 58 (34.07), G5- DMIL 150 (36.28), G19- DMID 16 (38.35), G7- DMIL 112 (40.95) and G1- DMIL 281 (41.04) (Table 3). The interaction effects between moisture regimes and genotypes were significant. The genotype G32- DMIL 50 (96.50) and G16- DMIL 13 (91.80) recorded significantly higher cob weight (g/cob) at M_1 moisture regime whereas, significantly lower cob weight (g/cob) was recorded in genotype G6- DMIT 30 (17.82), G12- DMIL 58 (18.45), G5- DMIL 150 (19.42), G19- DMID 16 (20.75), G7- DMIL 112 (22.15) and G17- DMIL 52 (22.23) at M_5 moisture regime.

At M_5 moisture regime genotype G32- DMIL 50 (36.57), G16- DMIL 13 (35.34), G15- DMIL 23 (34.91), G37- DMIDS 10 (32.96), G28- DMIT 01(32.57) and G39- DMIDS 28 (31.54) recorded significantly higher cob weight (g/cob) compared to other genotypes.

Number of seeds per cob

Irrespective of moisture regimes and genotypes G21- DMIL 47 (315.89), G28- DMIT 01 (314.83) and G24- DMIL 84 (311.70) recorded significantly higher number of seeds per cob and G6- DMIT 30 (96.67) and G19- DMID 16 (116.05) recorded significantly lower number of seeds per cob (Table 4). The interaction effects between moisture regimes and genotypes were significant. The genotype G21- DMIL 47 (438.00), G28- DMIT 01 (437.50), G24- DMIL 84 (431.00), G16- DMIL 13 (399.50) and G32- DMIL 50 (390.50) recorded significantly higher number of seeds per cob at M_1 moisture regime. Whereas, significantly lower number of seeds per cob was recorded in genotype G6- DMIT 30 (52.26), G19- DMID 16 (61.18), G5- DMIL 150 (70.68), G25- DMIL 99 (73.73), G7- DMIL 112 (82.39) and G23- DMID 05 (90.29) at M_5 moisture regime. At M5 moisture regime genotype G21- DMIL 47 (170.82), G28- DMIT 01 (170.63), G24- DMIL 84 (168.09), G16- DMIL 13 (155.81), G32- DMIL 50 (150.73) and G10- DMIT 27 (140.99) recorded significantly higher number of seeds per cob compared to other genotypes.

Shelling percentage (%)

Irrespective of moisture regimes and genotypes G12- DMIL 58 (87.30), G38- DMIDS 15 (85.01), G39- DMIDS 28 (84.99), G26- DMIL 63 (84.80), G24- DMIL 84 (83.83) and G4- DMIL 78 (83.44) recorded significantly higher shelling percentage. G2-

DMIL 29 (25.75) recorded significantly lower shelling percentage (Table 5).

The interaction effects between moisture regimes and genotypes were significant. The genotype G12- DMIL 58 (87.32), G38- DMIDS 15 (84.91), G39- DMIDS 28 (84.87), G26- DMIL 63 (84.82), G24- DMIL 84 (83.80) and G4- DMIL 78 (83.44) recorded significantly higher shelling percentage at M_1 moisture regime. Whereas, significantly lower shelling percentage was recorded in genotype G2- DMIL 29 (25.70) at M5 moisture regime. At M_5 moisture regime genotype G38- DMIDS 15 (86.01), G12- DMIL 58 (85.97), G8- DMIT 11 (85.09), G39- DMIDS 28 (84.87), G26- DMIL 63 (84.82) and G24- DMIL 84 (83.80) recorded significantly higher shelling percentage compared to other genotypes.

Test weight (100 grain weight) (gram)

Irrespective of moisture regimes and genotypes G6- DMIT 30 (22.07) recorded significantly higher test weight (g) 100 seeds and G1- DMIL 281 (11.02), G23- DMID 05 (11.20), G18- DMIL 41 (11.35), G17- DMIL 52 (11.35) and G2- DMIL 29 (11.41) recorded significantly lower test weight (g) (Table 6).

The interaction effects between moisture regimes and genotypes were significant. The genotype G6- DMIT 30 (30.60) recorded significantly higher test weight (gram) at M_1 moisture regime. Whereas, significantly lower test weight (gram) was recorded in genotypes G12- DMIL 58 (5.43), G1- DMIL 281 (5.80), G2- DMIL 29 (6.08), G23- DMID 05 (6.12), G18- DMIL 41 (6.20) and G17- DMIL 52 (6.20) at M5 moisture regime. At M_5 moisture regime genotype G6- DMIT 30 (11.93), G33- DMIDS 12 (10.64), G19- DMID 16 (10.44), G15- DMIL 23 (10.12), G37- DMIDS 10 (9.92) and G36- DMIDS 33 (9.72) recorded significantly higher test weight (gram) compared to other genotypes. These results indicated that, the genotypes should either possess higher test weight or higher number of seeds per plant in order to produce higher yield levels. These findings are in conformity with the reports of Kumar and Chaudhary (1986) and Jagtap and Kolhe (1986).

Harvest index (%)

Irrespective of moisture regimes and genotypes G23- DMID 05 (38.42) recorded significantly higher harvest index (%) and G32- DMIL 50 (17.62), G16- DMIL 13 (17.62), G28- DMIT 01 (17.89), G14- DMIL 117 (18.86), G15- DMIL 23 (19.02) and G2- DMIL 29 (19.29) recorded significantly lower harvest index (%) (Table7).

The interaction effects between moisture regimes and genotypes were significant. The genotype G23- DMID 05 (40.39) recorded significantly higher harvest index (%) at M_1 moisture regime. Whereas, significantly lower harvest index (%) was recorded in genotype G32- DMIL 50 (14.37), G16- DMIL 13 (14.41), G28- DMIT 01 (14.59), G14- DMIL 117 (15.38), G15- DMIL 23 (15.59) and G2- DMIL 29 (15.81) at M5 moisture regime. At M_5 moisture regime genotype G23- DMID 05 (31.43) recorded significantly higher value at harvest index (%) compared to other genotypes.

Table 1: Particulars of water used in line source sprinkler irrigation technique

Sl. No.	Particulars	M_1	M_2	M_3	M_4	M_5
1	Amount of water supplied (ml)	42703.07	37424.12	26911.88	16335.31	10826.70
2	Amount of water received through rain (ml)	1786.00	1786.00	1786.00	1786.00	1786.00
3	Total amount of water (ml)	44489.07	39210.12	28697.88	18121.31	12612.70
4	Amount of water in (kg) (1ml=0.997g)	44355.61	39092.49	28611.79	18066.94	12574.86
5	Amount of water in cm (area of container 38.46 cm^2)	67.14	59.18	43.31	27.35	19.04
6	Moisture deficit (%)	11.17	-2.02	-28.29	-54.72	-68.48

(Cumulative pan evaporation during the experimentation = 60.40 cm)

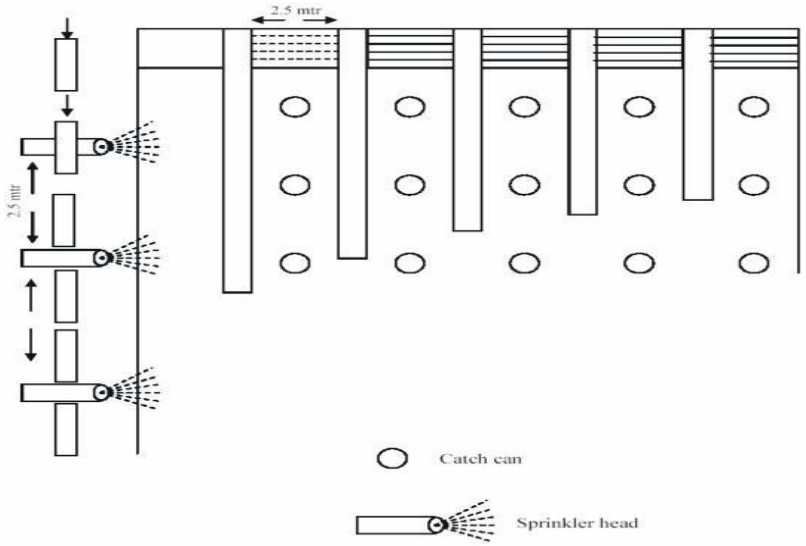

Fig. 1: The line source sprinkler irrigation system and field arrangement of genotypes and catch cans used to establish a gradient of soil moisture

Table 2: Yield (kg/ha) as influenced by different moisture regimes in maize genotypes

Sl. No.	Genotypes	Yield (kg/ha)					Mean
		Moisture regimes					
		M_1	M_2	M_3	M_4	M_5	
1	G1: DMIL 281	3702	3350	2777	2070	1429	2666
2	G2: DMIL 29	1436	1304	1077	812	559	1038
3	G3: NMI 15	4087	3707	3057	2305	1594	2950
4	G4: DMIL 78	5814	5291	4302	3314	2209	4186
5	G5: DMIL 150	3540	3221	2641	1982	1380	2553
6	G6: DMIT 30	3164	2872	2369	1803	1202	2282
7	G7: DMIL 112	3531	3178	2648	1995	1377	2546
8	G8: DMIT 11	5267	4772	3897	2992	2054	3796
9	G9: DMIL 132	4814	4376	3557	2729	1829	3461
10	G10: DMIT 27	5198	4731	3847	2963	1970	3742
11	G11: DMIL 77	4318	3886	3238	2461	1662	3113
12	G12: DMIL 58	3531	3175	2648	2006	1356	2543
13	G13: DMID 35	4660	4194	3495	2609	1817	3355
14	G14: DMIL 117	4916	4474	3638	2783	1868	3536
15	G15: DMIL 23	5754	5236	4316	3274	2244	4165
16	G16: DMIL 13	6113	5502	4554	3485	2354	4402
17	G17: DMIL 52	3702	3328	2769	2073	1436	2662
18	G18: DMIL 41	3848	3482	2874	2151	1489	2769
19	G19: DMID 16	3540	3200	2655	1982	1380	2551
20	G20: DMID 09	4378	3984	3283	2495	1707	3169
21	G21: DMIL 47	5686	5117	4253	3241	2206	4101
22	G22: DMID 147	4942	4497	3657	2767	1878	3548
23	G23: DMID 05	3121	2824	2328	1779	1205	2251
24	G24: DMIL 84	5575	5062	4175	3178	2169	4032
25	G25: DMIL 99	3369	3055	2527	1903	1314	2434
26	G26: DMIL 63	4968	4520	3676	2822	1888	3575
27	G27: DMIT 65	4856	4419	3589	2754	1841	3492
28	G28: DMIT 01	5814	5279	4302	3314	2209	4184
29	G29: DMID 02	4745	4271	3559	2705	1851	3426
30	G30: DMIL 97	4703	4260	3527	2671	1834	3399
31	G31: DMIT 110	4677	4251	3461	2619	1824	3366
32	G32: DMIL 50	6626	6030	4897	3750	2518	4764
33	G33: DMIDS 12	4514	4063	3363	2569	1761	3254
34	G34: DMIDS 03	4343	3905	3231	2476	1672	3126
35	G35: DMIDS 21	4403	3963	3302	2466	1708	3169
36	G36: DMIDS 33	4660	4240	3448	2605	1803	3351
37	G37: DMIDS 10	5515	5018	4136	3088	2151	3982
38	G38: DMIDS 15	5771	5252	4300	3290	2251	4173
39	G39: DMIDS 28	5900	5310	4413	3363	2289	4255
40	G40: DMIDS 07	4232	3851	3161	2370	1608	3045
Mean		4593	4161	3424	2600	1772	
For comparison of		S.Em. ±			CD @ 0.05		
Moisture regimes (M)		41.10			121.65		
Genotypes (G)		116.24			344.07		
M x G		259.92			769.37		

M1 = +11.17 M2 = -2.02 M3 = -28.29 M4 = -54.72 M5 = -68.48

Table 3: Cob weight (g) as influenced by different moisture regimes in maize genotypes

Sl. No.	Genotypes	Cob weight (g)					Mean
		Moisture regimes					
		M_1	M_2	M_3	M_4	M_5	
1	G1: DMIL 281	57.00	51.24	42.52	32.21	22.23	41.04
2	G2: DMIL 29	65.20	59.01	48.83	37.03	25.43	47.10
3	G3: NMI 15	61.60	55.69	46.20	34.93	23.90	44.46
4	G4: DMIL 78	81.50	74.17	60.31	46.46	30.97	58.68
5	G5: DMIL 150	50.30	45.27	37.73	28.67	19.42	36.28
6	G6: DMIT 30	45.80	41.68	33.89	26.01	17.82	33.04
7	G7: DMIL 112	56.80	51.40	42.60	31.81	22.15	40.95
8	G8: DMIT 11	74.30	67.46	55.73	42.05	28.23	53.56
9	G9: DMIL 132	72.80	66.03	53.87	41.42	27.59	52.34
10	G10: DMIT 27	80.30	73.07	59.34	45.77	30.51	57.80
11	G11: DMIL 77	65.30	59.42	48.65	36.57	25.47	47.08
12	G12: DMIL 58	47.30	42.95	35.19	26.44	18.45	34.07
13	G13: DMID 35	74.50	67.05	55.88	41.72	29.06	53.64
14	G14: DMIL 117	72.80	65.96	53.87	41.50	27.66	52.36
15	G15: DMIL 23	89.50	81.36	67.13	51.02	34.91	64.78
16	G16: DMIL 13	91.80	83.54	68.39	51.41	35.34	66.10
17	G17: DMIL 52	57.30	51.57	42.86	32.03	22.23	41.20
18	G18: DMIL 41	59.80	53.76	44.67	33.79	23.14	43.03
19	G19: DMID 16	53.20	47.88	39.90	30.00	20.75	38.35
20	G20: DMID 09	64.00	58.24	48.00	36.48	24.96	46.34
21	G21: DMIL 47	80.30	73.07	60.06	44.97	31.16	57.91
22	G22: DMID 147	75.00	67.50	55.50	42.75	28.50	53.85
23	G23: DMID 05	64.50	58.70	48.12	36.44	24.90	46.53
24	G24: DMIL 84	77.80	70.80	58.27	44.19	30.26	56.26
25	G25: DMIL 99	58.10	52.58	43.58	32.94	22.66	41.97
26	G26: DMIL 63	68.50	62.20	50.69	39.05	26.03	49.29
27	G27: DMIT 65	80.30	72.83	59.34	45.77	30.43	57.74
28	G28: DMIT 01	85.70	77.99	63.42	48.68	32.57	61.67
29	G29: DMID 02	76.50	69.62	57.38	42.84	29.84	55.23
30	G30: DMIL 97	66.30	60.20	49.73	37.53	25.86	47.92
31	G31: DMIT 110	68.00	61.20	51.00	38.69	25.84	48.95
32	G32: DMIL 50	96.50	87.43	71.41	55.01	36.57	69.38
33	G33: DMIDS 12	66.80	60.72	50.10	37.41	25.72	48.15
34	G34: DMIDS 03	71.30	64.88	53.12	39.86	27.38	51.31
35	G35: DMIDS 21	71.50	64.35	53.48	40.04	27.89	51.45
36	G36: DMIDS 33	76.00	68.32	56.77	43.32	28.88	54.66
37	G37: DMIDS 10	84.50	76.05	63.38	48.17	32.96	61.01
38	G38: DMIDS 15	79.50	72.35	59.63	45.32	30.61	57.48
39	G39: DMIDS 28	81.30	73.98	60.81	45.53	31.54	58.63
40	G40: DMIDS 07	66.00	59.40	48.84	37.62	25.54	47.48
Mean		70.39	63.77	52.50	39.84	27.13	
For comparison of		S.Em. ±			CD @ 0.05		
Moisture regimes (M)		0.63			1.87		
Genotypes (G)		1.79			5.30		
M x G		4.00			11.84		

M1 = +11.17 M2 = -2.02 M3 = -28.29 M4 = -54.72 M5 = -68.48

Table 4: Number of seeds per cob as influenced by different moisture regimes in maize genotypes

Sl. No.	Genotypes	Number of seeds per cob					Mean
		Moisture regimes					
		M_1	M_2	M_3	M_4	M_5	
1	G1: DMIL 281	322.00	291.73	239.89	183.54	122.04	231.84
2	G2: DMIL 29	241.00	219.07	180.27	137.37	92.79	174.10
3	G3: NMI 15	241.50	219.77	180.40	137.17	92.74	174.31
4	G4: DMIL 78	278.50	250.65	208.88	155.96	108.62	200.52
5	G5: DMIL 150	186.00	169.26	139.50	105.28	70.68	134.14
6	G6: DMIT 30	134.00	120.60	100.23	76.25	52.26	96.67
7	G7: DMIL 112	214.00	194.74	158.36	121.98	82.39	154.29
8	G8: DMIT 11	348.00	316.68	259.61	194.88	135.02	250.84
9	G9: DMIL 132	239.50	215.55	179.39	133.88	92.69	172.20
10	G10: DMIT 27	361.50	324.99	271.13	202.44	140.99	260.21
11	G11: DMIL 77	250.00	226.25	185.00	142.50	97.50	180.25
12	G12: DMIL 58	274.00	247.70	202.49	156.18	106.31	197.33
13	G13: DMID 35	242.50	220.68	179.45	138.23	92.15	174.60
14	G14: DMIL 117	307.00	276.30	230.25	171.92	118.50	220.79
15	G15: DMIL 23	285.00	259.35	213.75	162.45	110.87	206.28
16	G16: DMIL 13	399.50	361.55	295.63	225.72	155.81	287.64
17	G17: DMIL 52	316.50	287.38	233.89	179.77	120.27	227.56
18	G18: DMIL 41	327.00	296.59	243.62	185.41	123.93	235.31
19	G19: DMID 16	161.00	146.51	119.78	91.77	61.18	116.05
20	G20: DMID 09	283.50	257.99	212.63	161.60	110.57	205.25
21	G21: DMIL 47	438.00	397.70	324.12	248.78	170.82	315.89
22	G22: DMID 147	342.00	307.80	256.50	191.52	129.96	245.56
23	G23: DMID 05	231.50	209.74	172.47	131.03	90.29	167.00

24	G24: DMIL 84	431.00	391.78	322.39	245.24	168.09	311.70
25	G25: DMIL 99	191.50	174.27	143.05	109.16	73.73	138.34
26	G26: DMIL 63	308.00	277.20	231.00	172.48	119.50	221.64
27	G27: DMIT 65	268.50	241.38	201.38	150.09	103.91	193.05
28	G28: DMIT 01	437.50	393.75	327.25	245.00	170.63	314.83
29	G29: DMID 02	267.00	242.97	197.58	152.19	104.13	192.77
30	G30: DMIL 97	295.00	268.45	220.07	168.15	114.46	213.23
31	G31: DMIT 110	294.00	267.54	220.21	164.64	111.72	211.62
32	G32: DMIL 50	390.50	351.45	292.88	218.29	150.73	280.77
33	G33: DMIDS 12	254.00	231.14	187.96	143.51	98.81	183.08
34	G34: DMIDS 03	275.00	248.88	203.23	155.10	107.25	197.89
35	G35: DMIDS 21	280.00	254.24	207.20	159.60	106.40	201.49
36	G36: DMIDS 33	251.50	228.11	188.63	140.84	95.32	180.88
37	G37: DMIDS 10	294.00	267.54	220.50	167.58	111.72	212.27
38	G38: DMIDS 15	340.50	309.86	255.38	192.38	132.80	246.18
39	G39: DMIDS 28	344.00	312.35	254.56	195.39	134.16	248.09
40	G40: DMIDS 07	272.50	245.25	204.38	154.51	103.55	196.04
Mean		290.45	263.12	216.62	164.24	112.13	
For comparison of		S.Em. ±			CD @ 0.05		
Moisture regimes (M)		2.63			7.79		
Genotypes (G)		7.45			22.04		
M x G		16.65			49.28		

M1 = +11.17 M2 = -2.02 M3 = -28.29 M4 = -54.72 M5 = -68.48

Table 5: Shelling percentage (%) of maize genotypes as influenced by different moisture regimes

Sl. No.	Genotypes	Shelling percentage (%)					Mean
		Moisture regimes					
		M_1	M_2	M_3	M_4	M_5	
1	G1: DMIL 281	75.96	76.47	76.37	75.16	75.19	75.83
2	G2: DMIL 29	25.77	25.85	25.80	25.63	25.70	25.75
3	G3: NMI 15	77.60	77.85	77.39	77.19	78.00	77.61
4	G4: DMIL 78	83.44	83.44	83.44	83.44	83.44	83.44
5	G5: DMIL 150	82.31	83.22	81.87	80.86	83.16	82.28
6	G6: DMIT 30	80.79	80.61	81.77	81.07	78.92	80.63
7	G7: DMIL 112	72.71	72.31	72.71	73.36	72.71	72.76
8	G8: DMIT 11	82.91	82.72	81.80	83.20	85.09	83.14
9	G9: DMIL 132	77.34	77.51	77.23	77.06	77.54	77.33
10	G10: DMIT 27	75.72	75.72	75.82	75.72	75.52	75.70
11	G11: DMIL 77	77.34	76.49	77.85	78.72	76.34	77.35
12	G12: DMIL 58	87.32	86.45	88.02	88.72	85.97	87.30
13	G13: DMID 35	73.15	73.15	73.15	73.15	73.15	73.15
14	G14: DMIL 117	78.98	79.33	78.98	78.43	78.98	78.94
15	G15: DMIL 23	75.20	75.28	75.20	75.06	75.20	75.19
16	G16: DMIL 13	77.89	77.03	77.89	79.28	77.89	77.99
17	G17: DMIL 52	75.57	75.48	75.57	75.70	75.57	75.58
18	G18: DMIL 41	75.25	75.75	75.25	74.45	75.25	75.19
19	G19: DMID 16	77.82	78.17	77.82	77.27	77.82	77.78
20	G20: DMID 09	80.00	80.00	80.00	80.00	80.00	80.00
21	G21: DMIL 47	82.81	81.90	82.81	84.29	82.81	82.93
22	G22: DMID 147	77.07	77.92	77.07	75.71	77.07	76.97
23	G23: DMID 05	56.59	56.28	56.59	57.09	56.59	56.63
24	G24: DMIL 84	83.80	83.62	83.80	84.10	83.80	83.83
25	G25: DMIL 99	67.81	67.96	67.81	67.57	67.81	67.80
26	G26: DMIL 63	84.82	85.00	84.82	84.52	84.82	84.80
27	G27: DMIT 65	70.73	70.97	70.73	70.36	70.73	70.71
28	G28: DMIT 01	79.35	79.17	79.35	79.63	79.35	79.37
29	G29: DMID 02	72.55	71.75	72.55	73.84	72.55	72.65
30	G30: DMIL 97	82.96	82.77	82.96	83.25	82.96	82.98
31	G31: DMIT 110	80.44	81.25	79.37	79.17	82.56	80.56
32	G32: DMIL 50	80.31	80.67	80.20	79.75	80.52	80.29
33	G33: DMIDS 12	79.04	78.26	78.51	80.31	80.07	79.24
34	G34: DMIDS 03	71.25	70.39	71.15	72.65	71.43	71.37
35	G35: DMIDS 21	72.03	72.03	72.22	72.03	71.66	71.99
36	G36: DMIDS 33	71.71	72.59	71.04	70.33	73.03	71.74
37	G37: DMIDS 10	76.33	77.18	76.33	74.99	76.33	76.23
38	G38: DMIDS 15	84.91	84.91	84.34	84.91	86.01	85.01
39	G39: DMIDS 28	84.87	83.94	84.87	86.39	84.87	84.99
40	G40: DMIDS 07	75.00	75.83	75.71	73.68	73.64	74.77
Mean		76.19	76.18	76.15	76.20	76.25	
For comparison of		S.Em. ±			CD @ 0.05		
Moisture regimes (M)		0.69			2.05		
Genotypes (G)		1.96			5.79		
M x G		4.37			12.94		

M1 = +11.17 M2 = -2.02 M3 = -28.29 M4 = -54.72 M5 = -68.48

Table 6: Test weight (g) as influenced by different moisture regimes in maize genotypes

Sl. No.	Genotypes	Test weight (g)					Mean
		Moisture regimes					
		M_1	M_2	M_3	M_4	M_5	
1	G1: DMIL 281	15.30	13.86	11.40	8.72	5.80	11.02
2	G2: DMIL 29	15.80	14.36	11.82	9.01	6.08	11.41
3	G3: NMI 15	22.70	20.66	16.96	12.89	8.72	16.38
4	G4: DMIL 78	24.30	21.87	18.23	13.61	9.48	17.50
5	G5: DMIL 150	23.20	21.11	17.40	13.13	8.82	16.73
6	G6: DMIT 30	30.60	27.54	22.89	17.41	11.93	22.07
7	G7: DMIL 112	21.50	19.57	15.91	12.26	8.28	15.50
8	G8: DMIT 11	17.70	16.11	13.20	9.91	6.87	12.76
9	G9: DMIL 132	25.00	22.50	18.73	13.98	9.68	17.98
10	G10: DMIT 27	19.30	17.35	14.48	10.81	7.53	13.89
11	G11: DMIL 77	23.80	21.54	17.61	13.57	9.28	17.16
12	G12: DMIL 58	14.00	12.66	10.35	7.98	5.43	10.08
13	G13: DMID 35	22.30	20.52	16.95	12.93	8.92	16.32
14	G14: DMIL 117	20.30	18.68	15.43	11.77	8.12	14.86
15	G15: DMIL 23	25.30	23.28	19.23	14.67	10.12	18.52
16	G16: DMIL 13	17.30	15.92	13.15	10.03	6.92	12.66
17	G17: DMIL 52	15.50	14.26	11.78	8.99	6.20	11.35
18	G18: DMIL 41	15.50	14.26	11.78	8.99	6.20	11.35
19	G19: DMID 16	26.10	24.01	19.84	15.14	10.44	19.11
20	G20: DMID 09	23.20	21.34	17.63	13.46	9.28	16.98
21	G21: DMIL 47	21.70	19.96	16.49	12.59	8.68	15.88
22	G22: DMID 147	18.00	16.56	13.68	10.44	7.20	13.18
23	G23: DMID 05	15.30	14.08	11.63	8.87	6.12	11.20
24	G24: DMIL 84	21.00	19.32	15.96	12.18	8.40	15.37
25	G25: DMIL 99	21.20	19.50	16.11	12.30	8.48	15.52
26	G26: DMIL 63	20.70	19.04	15.73	12.01	8.28	15.15
27	G27: DMIT 65	20.50	18.86	15.58	11.89	8.20	15.01
28	G28: DMIT 01	16.80	15.46	12.77	9.74	6.72	12.30
29	G29: DMID 02	20.40	18.77	15.50	11.83	8.16	14.93
30	G30: DMIL 97	19.00	17.48	14.44	11.02	7.60	13.91
31	G31: DMIT 110	19.20	17.66	14.59	11.14	7.68	14.05
32	G32: DMIL 50	20.30	18.68	15.43	11.77	8.12	14.86
33	G33: DMIDS 12	26.60	24.47	20.22	15.43	10.64	19.47
34	G34: DMIDS 03	16.50	15.18	12.54	9.57	6.60	12.08
35	G35: DMIDS 21	17.50	16.10	13.30	10.15	7.00	12.81
36	G36: DMIDS 33	24.30	22.36	18.47	14.09	9.72	17.79
37	G37: DMIDS 10	24.80	22.82	18.85	14.38	9.92	18.15
38	G38: DMIDS 15	19.30	17.76	14.67	11.19	7.72	14.13
39	G39: DMIDS 28	19.70	18.12	14.97	11.43	7.88	14.42
40	G40: DMIDS 07	17.00	15.64	12.92	9.86	6.80	12.44
Mean		20.46	18.73	15.46	11.78	8.10	
For comparison of		S.Em. ±			CD @ 0.05		
Moisture regimes (M)		0.18			0.54		
Genotypes (G)		0.52			1.53		
M x G		1.16			3.42		

M1 = +11.17 M2 = -2.02 M3 = -28.29 M4 = -54.72 M5 = -68.48

Table 7: Harvest index (%) as influenced by different moisture regimes in maize genotypes

Sl. No.	Genotypes	Harvest index (%)					Mean
		Moisture regimes					
		M_1	M_2	M_3	M_4	M_5	
1	G1: DMIL 281	22.89	23.72	23.02	21.42	17.81	21.77
2	G2: DMIL 29	20.28	21.01	20.39	18.98	15.81	19.29
3	G3: NMI 15	23.02	23.86	23.15	21.55	17.96	21.91
4	G4: DMIL 78	21.75	22.54	21.87	20.38	16.87	20.68
5	G5: DMIL 150	24.12	24.99	24.26	22.57	18.82	22.95
6	G6: DMIT 30	30.96	32.08	31.13	29.00	24.01	29.44
7	G7: DMIL 112	21.94	22.74	22.06	20.54	17.12	20.88
8	G8: DMIT 11	20.62	21.36	20.73	19.31	16.08	19.62
9	G9: DMIL 132	21.62	22.41	21.75	20.25	16.77	20.56
10	G10: DMIT 27	20.84	21.59	20.95	19.52	16.15	19.81
11	G11: DMIL 77	22.88	23.72	23.01	21.44	17.80	21.77
12	G12: DMIL 58	23.51	24.37	23.64	22.02	18.27	22.36
13	G13: DMID 35	20.91	21.67	21.02	19.56	16.31	19.89
14	G14: DMIL 117	19.83	20.55	19.94	18.57	15.38	18.86
15	G15: DMIL 23	19.98	20.70	20.09	18.72	15.59	19.02
16	G16: DMIL 13	18.52	19.20	18.63	17.35	14.41	17.62
17	G17: DMIL 52	21.72	22.51	21.84	20.32	16.92	20.66
18	G18: DMIL 41	22.28	23.09	22.41	20.85	17.35	21.20
19	G19: DMID 16	24.01	24.88	24.14	22.46	18.72	22.84
20	G20: DMID 09	21.40	22.17	21.52	20.05	16.69	20.37
21	G21: DMIL 47	22.54	23.36	22.66	21.11	17.56	21.45
22	G22: DMID 147	21.47	22.24	21.59	20.09	16.65	20.41
23	G23: DMID 05	40.39	41.85	40.61	37.84	31.43	38.42

24	G24: DMIL 84	20.91	21.67	21.03	19.59	16.30	19.90
25	G25: DMIL 99	23.98	24.85	24.12	22.46	18.71	22.82
26	G26: DMIL 63	21.24	22.01	21.36	19.89	16.47	20.19
27	G27: DMIT 65	20.86	21.61	20.98	19.53	16.17	19.83
28	G28: DMIT 01	18.81	19.49	18.92	17.62	14.59	17.89
29	G29: DMID 02	20.36	21.10	20.47	19.07	15.88	19.38
30	G30: DMIL 97	21.45	22.23	21.57	20.09	16.73	20.41
31	G31: DMIT 110	21.84	22.62	21.96	20.43	17.03	20.78
32	G32: DMIL 50	18.53	19.20	18.64	17.35	14.37	17.62
33	G33: DMIDS 12	22.50	23.33	22.63	21.08	17.55	21.42
34	G34: DMIDS 03	23.52	24.38	23.65	22.03	18.29	22.37
35	G35: DMIDS 21	21.45	22.23	21.57	20.07	16.71	20.40
36	G36: DMIDS 33	22.36	23.16	22.48	20.92	17.41	21.26
37	G37: DMIDS 10	20.95	21.71	21.07	19.61	16.34	19.94
38	G38: DMIDS 15	21.34	22.11	21.46	19.99	16.65	20.31
39	G39: DMIDS 28	21.05	21.82	21.17	19.72	16.40	20.03
40	G40: DMIDS 07	23.12	23.96	23.25	21.64	17.93	21.98
Mean		22.29	23.10	22.42	20.87	17.35	
For comparison of		S.Em. ±			CD @ 0.05		
Moisture regimes (M)		0.21			0.62		
Genotypes (G)		0.59			1.74		
M x G		1.32			3.90		

M1 = +11.17 M2 = -2.02 M3 = -28.29 M4 = -54.72 M5 = -68.48

CONCLUSION

Considering all the above parameters under severe moisture stress the genotypes , G32-DMIL 50, G16-DMIL 13, G39- DMIDS 28, G4-DMIL 78, G28-DMIT 01, G38-DMIDS 15, G15-DMIL 23, G21-DMIL 47, G24-DMIL 84 and G37-DMIDS 10 performed well compared to other genotypes. The genotype G32- DMIL 50 found promising under various moisture regimes.

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