

## Investigate the Interaction of Genotypes on the Environment in Terms of Drought Tolerance Indices in the Lentil Genotypes

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### ABSTRACT

To determine the lentil genotypes in Meshginshahr region in terms of drought tolerance and also the study of interaction between genotype and environment, 17 lentil genotypes were grown and evaluated in both stress and non-stress conditions as randomized complete block design in three replicates. The traits included: germination percentage, plant height, biomass, days to flowering, days to maturity, the primary stem, the secondary stem, leaflet, fill pod, hundred seed weight, harvest index, grain yield, single plant weight and number of seeds per plant. Simple and combined analysis of variance for traits was performed in both stress and non-stress conditions. The reaction of different cultivars of lentils was varied at both conditions that indicate the existence of genetic variation among genotypes, regardless of the environment effect. Drought stress decreased all traits especially grain yield, harvest index, single plant weight and plant height. Mean comparison of traits showed that genotype ILL-10179 had the highest yield in both under stress and non-stress conditions. The correlation results showed that traits such as harvest index and single plant weight have a positive effect on the yield at 1% level. Quantitative indices of resistance were calculated including arithmetic mean (MP), geometric mean (GMP), stress tolerance index (STI), stress susceptibility indicators (SSI) and tolerance (TOL). There was significant difference between genotypes in terms all drought resistance indices. The results of this study indicate that characteristics such as height, biomass, days to flowering, number of leaflet, hundred seed weight, harvest index, number of seeds per plant and seed weight of per plant can be introduced as indicators to select in order to improve the yield of lentil seed under stress condition and traits such as plant height, leaflet, hundred seed weight, harvest index and single plant weight can be introduced under non stress condition. So, among the studied lines, line ILL-10179 were recommended for dry land conditions and lines ILL- 10179 and Local susceptible- 13 for water conditions for Meshginshahr region and also the similar regions.

**KEYWORDS:** Drought resistance indices, lentil, drought stress, Meshginshahr

### INTRODUCTION AND REFERENCES SURVEY

Lentil is a plant from legumes family with the scientific name *Lens culinaris* Madke based on the classification (Kronquist, 1981), *Lens* genus belonging to the *Viciae* tribe, *Fabaceae* family, *Fabales* order, *Rosales* suborder and *agnolia Magnoliopsida* order. One of the main products is belonging to the legumes family (Robina et al, 2003). It is very valuable in terms of the alimentary and the protein amount is usually between 23 to 27 percent. Its chaff is also valuable as the grain in livestock feed, especially in dry years. The high protein content of lentil and on the other hand drought resistance of the lentils which provides a dry cultivation has put it in rows of agronomical important plants (Bagheri et al, 1997). Lentil is considered one of the main sources of foods and vegetable protein (Manyr et al, 2004). Ecological requirements and climatic conditions are different among the lentils varieties so that a variety may have the high productivity capacity in terms genetically however do not have this capacity in adverse environmental conditions (Neyestani & Azim zadeh, 2003). The relative performance of lentils is low due to different reasons in Iran. The cause of this issue can be attributed to deselection of the appropriate planting date and timely combat weeds (Canooni, 1995). Iran has long been used as a spring planting lentils. Usually planting lentils delay in some cases to early May due to winter rains and soil moisture for tillage operations and provide seedbed (Pezeshkpour, 2002). One of the major factors in drought resistance of the plants is the ability of cells to tolerate high levels of water loss without the irreparable harm. More vacuole usually shrinks from the rim with the drying cell. Therefore it leads to the rupture of protoplasm. It appears that cell structure damage is the main cause of cell death which has no ability to resist drought. Reduce the performance of plants under conditions of water scarcity is one of the major issues whom plant reformers face with it and they emphasize on improving plant performance in these circumstances. But the difference in plant yield potential is more relevant to the adjustment factors to stress than stress tolerance itself. Therefore, drought tolerances indices are used in these circumstances to determine the resistant genotypes (Ahanghari, 2007). About water requirement and lentil irrigation in areas which is cultivated in the non-rainy season, their reaction depends on the amount of moisture stored in the soil, amount of rainfall in the years before cultivation, depth and texture of the soil. Critical stage need for water is the flowering stage. Lentil is very sensitive to more than usual irrigation and water logging soils. Being flooded caused to roots faced with oxygen deficiency, efficiency reduction and root weight, plant dry weight, moderate levels of leaf,

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leaf area per plant, number of leaves per plant, branching and number of reproductive organs and so the decline in yield. This reaction is manifested among different cultivars (Tyvari & Viyaz, 1994).

West central Asia and southern Europe to Spain have identified as the origin of four species of wild lentils, Iran is introduced as a source of species *L. orientalis* (Koubru, 1981). Considering the fact that Iran is one of the major centers of lentils diversity in the world, the genetic research inheritance reserves attempt to collect landrace and wild relatives of the crop a long time and the lentils spawned of this part currently has a prototype in 2600 lentil and wild native in Iran. Existence a good understanding of the genetic diversity in crop species and their wild relatives is prerequisite for an effective genetic conservation programs (Ferguson & Robertson, 1996).

The yield is a complex quantitative trait is controlled by many genes and is strongly affected by environment (Hoshmand, 2002). Legumes are plants that their grain yield usually varies from year to year and water shortage is one of the factors in it (Ferguson et al, 1998). The number of pod in the legumes has the greatest impact on the yield (Sinha et al, 1988). Lack of water has the greatest impact on yield components of lentil including it caused to produce fewer pod per plant and fewer seeds per pod and also a reduction in seed weight. As a result, the number of pods per plant, number of seeds per pod and seed hundred grain weights of lentil increases. Lentil grain yield also reduced under water restriction conditions. (Alkaleh & Samerfyld, 1994) and (Danveru Palyval, 1975) showed that one irrigation in the grain filling stage increases lentil yield. In the other reports is mentioned that, three times irrigation in the grain filling stage increases lentil yield (Skin & Ashkar, 1993). Water deficit in the soybean cause the number of flowers, number of pod, pod size, number of seed per pod and seed weight (Deskolas et al, 2000 & Foroud et al, 1993).

The purpose of this study was to assess the genetic diversity of different cultivars lentil in terms of drought tolerance, yield and the yield components of each cultivar and examine the relationships between different traits and also determining yield with the greatest impact on yield in lentil.

## MATERIALS AND METHODS

To evaluate drought tolerance indices of lentil varieties, a test was conducted in Meshginshahr during 2010. 17 lentil genotypes were used in this experiment (Table 1). The randomized complete block design was with three replications and the test was conducted in both dry land and irrigated conditions.

Table 1 - Names of 17 lentil genotypes studied in experiment

Number of Line	Name and code of line	Number of Line	Name and code of line
1	ILL-10313	10	ILL -323
2	ILL-10179	11	7-AKM266
3	ILL-70275	12	2-ILL975
4	ILL-10085	13	5-AKM357
5	ILL-10172	14	1-P1299366
6	13- Local susceptible	15	ILL-10312
7	ILL -10311	16	ILL-10174
8	Flp 2003-3L	17	ILL-9893
9	ILL -9850		

The land preparation operations include deep plowing which was conducted in the fall of 2009. And it was planted in mid-April, 2010. Each cultivar consisted of three line three meters that was planted a distance of 30 cm from each other. Two lateral lines were considered as in the margin and a middle line as the source of samples for each treatment. When the lentils have reached the harvest stage, considering two lateral lines and 20 cm from the beginning and the end as the margin, one central line was removed in order to estimate the performance. The average of traits such as green percentage, biomass plant height, flowering date, maturity date, number of initial stem per plant, number of secondary stem per plant, number of leaflets, number of filled pods per plant, seed weight, harvest index, seed weight of single plant, number of seeds per plant and grain yield per unit area which randomly selected based on 10 competitive plants were measured and analyzed as follows:

Setting data was performed in Excel and variance analysis and mean comparisons in the MSTATC program using Duncan test at 5% level. Stepwise regression analysis, cluster analysis and correlation coefficients were conducted in SPSS program and path analysis by the PATH ANALYSIS program. Principal components analysis was performed in MINITAB.

## RESULTS AND DISCUSSION

Analysis of variance of data except for (dry and irrigated circumstances) showed there were significant differences among genotypes for all traits evaluated. This suggests the existence of genetic variation among genotypes, regardless of environment effect.

Mean comparison of traits by Duncan's method at 5% level showed that line ILL- 10179 had the highest grain yield in stress condition and lines ILL- 10179 and Local susceptible- 13 had the highest grain yield in non stress condition. These genotypes had high values in terms of seed weight of single plant, number of seeds per plant and

harvest index and were among early flowering and precocious genotypes in terms the number days to 50% flowering and number of days to maturity. Mostafaei (1999), Anjam et al (2005), Beghom and Beghom (1996) and Mostafaei et al (2006) have also reported significant difference for traits studied. Simple correlations between traits with grain yield in both stress and without stress showed that traits such as harvest index and seed weight of single plant in both conditions had the most positive and significant correlation with grain yield at 1% level.

Positive and significant correlation traits with yield showed using these traits can be useful in breeding programs. Studies of Karimi Vankuei (quoted source 7) shows that HI indicates transmission of organic matter is from source to storage. Cultivars with a higher harvest index are able to transfer more carbohydrates from green organ to grain and increase the grain yield. And cultivars have fewer harvest indexes transfer fewer carbohydrates to grain. Therefore they have lower yield among their cultivars. Abbas Suraki et al (2005) and Mostafaei et al (1998) have reported the yield has significant positive correlation with the harvest index. HI can be introduced as the basis for selection for improving lentil yield which correlation between grain yield and harvest index is positive and significant (Nakh Foroush, 1998). Irrigation increases harvest index of the lentils (Punu & Singh, 1993).

Mahmoudi et al (2005), Lutra and Sharma (1990) and Ramgiri et al (1989) reported there is no significant positive relationship between seed weight and yield which corresponds the results of this study. Also, in some research such as Mostafaei et al (2005), Neyestani (1998), Anjam et al (2005) and Beghom & Beghom, 1996) is reported there is significant positive relation between grain and biological yield, plant height and the number of plant per pod. Correlation of grain yield with number of days to 50% flowering and number of days to maturity was non-significant negative and show that the late flowering and late maturing genotypes have lower performance. This early flowering can be useful in dry conditions in terms grain yield. Also early genotypes complete their growth period under dry conditions before the occurrence of drought and excessive heat late in the growing season and stay safe the effects of drought stress at the end of growing season. Mostafaei et al (1998) the relationship between grain yield and days to maturity showed negative and significant. Whereas, Mahmoudi et al (1999) the relationship between growth duration and grain yield showed positive and significant and with number of days to 50% flowering reported non-significant. Correlation between days to 50% flowering was non-significant negative under stress but it was non-significant positive under without stress and showed that they are late maturity genotypes but maybe not in drought conditions. While, Mahmoudi et al (1999) have reported the correlation between these two traits is positive and significant at the 1% level. The correlation between plant height with grain yield and harvest index was positive in both conditions. To evaluate cultivars using the index TOL, the high rate of index has been indication for cultivars susceptibility to stress and the selection is based on small amounts of TOL. According to this index, line ILL-323 had the lowest amount of TOL and line ILL-10174 also had the greatest amount of TOL (sensitive varieties). For the MP index, it was also observed that line ILL-10179 with a maximum value of cultivar and ILL-70275 also had the lowest index. Using MP and TOL indices, there are the possibility of breakdown of the numbers has high performance under without stress than cultivars which have a higher relative yield only under stress (Rozył & Hambelyn, 1981). For the GMP index was also observed that line ILL-10179 with a maximum value of cultivar and ILL-70275 also had the lowest index. Lower value index (SSI) indicating little changes in performance of a genotype under stress condition than optimal conditions and thus the genotype is more stable. Using SSI index genotypes that have a relative advantage and higher performance in both natural and stress environment in terms of yield is distinct (Fischer & Maurer, 1978). Based on SSI, it was observed that line ILL-10179 had the lowest amount and line ILL-10174 also had the highest value of this index.

Using the index SSI, values higher than 1 show more sensitivity to drought stress and values lower than 1 indicates less sensitive to drought (Guthrie et al, 2001). GMP and SSI have been the mathematical derivation of performance data and selecting data based on the combination of both parameters can be appropriate criteria for the evaluation of drought resistance in plants (Ramiz and Kelly, 1998). STI index was also observed for the ILL-10179 had the highest amount and line ILL-70275 also had the lowest index.

Based on STI, cultivars are more stable have higher STI (Fernandez, 1999). Using this index, it may exist the recognition of cultivars has relative advantage in terms of yield in both normal and stress conditions and produce high performance. So among the lines studied, line ILL-10179 was introduced for dry conditions and lines ILL-10179 and Local susceptible-13 for water conditions for Meshginshahr and similar areas.

**Table 2 - Analysis of combined variance in 17 lentil genotypes under both drought and without drought stress**

SC	Df	Emergence percentage	Plant height	Biomass	Number of days to 50% flowering	Number of days to maturity	Number of primary stem	Number of Secondary stem	Number of leaflets	Number of fill pod	100 seed weight (gr)	Harvest index	Seed weight per plant	Number of grain per plant	Grain yield
<b>Conditions</b>	1	3241.422**	107.307**	1.643**	768.627**	627.539**	2.265**	3.69**	16.360**	751.539**	38.786**	1052.174**	0.407**	1929.312**	20911.782**
<b>Error 1</b>	4	6.569	0.017	0.002	0.961	0.569	0.016	0.014	0.026	1.326	0.024	6.245	0.003	6.258	116.788
<b>Line</b>	16	380.463**	5.613**	0.069**	15.088**	9.54**	0.154**	0.183**	1.102**	9.319**	1.065**	45.556**	0.017**	30.371**	1127.097**
<b>Line+ Conditions</b>	16	18.672 <sup>ns</sup>	0.482**	0.007**	4.961**	5.56**	0.047**	0.139**	0.150**	1.635**	0.110**	3.336**	0.003*	8.489**	111.788*
<b>Error 2</b>	64	14.027	0.048	0.001	0.659	1.85	0.011	0.003	0.007	0.360	0.016	1.230	0.002	2.056	57.783
<b>CV%</b>		5.18	1	2.66	1.55	1.64	4.55	1.02	0.85	4.49	1.98	5.06	9.93	6.32	11.28

\*\* And \* respectively significant at the 1% and 5% level

**Table 3 - Mean comparison of lentil lines in terms of traits measured under irrigation and dry land conditions**

Line	Emergence percentage	Height	Biomass	Number of days to flowering	Number of days to maturity	Primary stem	Secondary stem	Number of leaflets	Fill pod	100 seed weight	Harvest index	Grain yield	Seed weight per plant	Number of grain per plant
<b>1</b>	63.5 G	22.32 CD	1.1 EF	55.17 A	81.5 DE	2.16 E-G	5.15 CD	9.35 G	13.61 C-F	6.5 CD	20.06 DE	71.2 C	0.408 B-D	<b>20.85 E-G</b>
<b>2</b>	74.17 C-E	22.19 C-E	1.02 G	53.33 BC	82 C-E	2.06 G	5.02 EF	9.74 E	12.42 GH	6.03 E	28.46 A	97.69 A	0.523 A	<b>25.26 AB</b>
<b>3</b>	70.5 EF	22.04 DE	1.23 B	52.33 CD	84.5 A-C	2.48 AB	5.1 DE	9.83 DE	14.23 B-D	5.51 F	16.68 E	51.82 D	0.307 E	<b>21.67 DE</b>
<b>4</b>	87 A	22.17 C-E	1.41 A	51.67 DE	82.33 B-E	2.6 A	5.39 A	10.54 A	15.78 A	6.79 A	18.67 E	52.42 D	0.339 DE	<b>25.17 AB</b>
<b>5</b>	67.17 FG	20.83 G	1.09 F	48.83 F	83 A-E	2.24 C-G	5.09 D-F	9.92 CD	14.08 B-E	6.43 D	23.02 C	73.39 BC	0.406 B-D	<b>22.44 C-E</b>
<b>6</b>	78.17 B-D	22.23 C-E	1.38 A	51.33 DE	83.5 A-E	2.44 AB	5.26 B	10.62 A	14.39 BC	6.63 A-D	26.16 B	92.43 A	0.482 AB	<b>23.79 A-D</b>
<b>7</b>	72.5 D-F	23.38 A	1.16 CD	52.17 CD	82.83 B-E	2.13 FG	5.28 B	9.94 B-D	15.12 AB	6.69 A-C	20.21 DE	60.63 CD	0.389 C-E	<b>22.19 C-E</b>
<b>8</b>	75.67 C-E	21.14 G	1.11 D-F	54.67 AB	84.67 AB	2.37 B-D	5.28 B	9.9 CD	14.12 B-E	6.46 CD	19.25 E	53.11 D	0.336 DE	<b>21.2 D-F</b>
<b>9</b>	61.83 G	21.07 G	1.24 B	52.33 CD	82.33 B-E	2.32 B-F	5.23 BC	9.84 DE	13.05 E-G	6.65 A-D	23.71 C	85.56 AB	0.468 A-C	<b>20.97 E-G</b>
<b>10</b>	65.83 FG	22.74 B	1.23 B	53.5 BC	82.33 B-E	2.1 G	4.99 F	9.81 DE	11.66 HI	6.44 D	23.02 C	74.05 BC	0.418 B-D	<b>25.87 A</b>
<b>11</b>	83.83 AB	22.77 B	1.21 BC	50.5 E	81.33 E	2.14 FG	4.99 F	9.54 F	13.81 C-F	5.98 E	22.97 C	63.59 CD	0.388 C-E	<b>24.53 A-C</b>
<b>12</b>	60.83 G	21.57 F	1.15 C-E	51.5 DE	84 A-D	2.48 AB	5.07 D-F	9.1 H	13 E-G	5.69 F	22.04 CD	66.08 CD	0.380 DE	<b>21.78 DE</b>
<b>13</b>	76.5 C-E	19.73 I	1.02 G	51.33 DE	83 A-E	2.18 D-G	5.3 AB	9.24 G	11.39 I	5.61 F	18.92 E	56.68 D	0.346 DE	<b>23.09 B-E</b>
<b>14</b>	62.5 G	21.84 EF	1.12 D-F	53.67 BC	83.83 A-E	2.18 D-G	5.24 BC	10.08 B	13 EG	6.53 B-D	24.05 C	65.89 CD	0.399 CD	<b>18.51 G</b>
<b>15</b>	80.67 A-C	22.22 C-E	1.25 B	53.5 BC	81.5 DE	2.34 B-E	5.07 D-F	9.31 G	13.24 D-G	5.93 E	20.45 DE	59.80 CD	0.383 DE	<b>18.85 FG</b>
<b>16</b>	78.67 B-D	20.12 H	1.15 C-E	53.5 BC	84.67 AB	2.42 A-C	5.31 AB	10.03 BC	12.74 FG	6.76 AB	20.17 DE	56.10 D	0.374 DE	<b>23.79 A-D</b>
<b>17</b>	70.83 EF	22.57 BC	1.22 B	53.67 BC	85.5 A	2.41 BC	4.66 G	9.3 G	11.28 I	6.56 A-D	22.76 C	66.18 CD	0.382 DE	<b>25.73 AB</b>

**Table 4 - Simple correlation coefficients between traits evaluated under without applying drought stress**

<i>Traits</i>	<i>Emergence percentage</i>	<i>Height</i>	<i>Biomass</i>	<i>Number of days to flowering</i>	<i>Number of days to maturity</i>	<i>Primary stem</i>	<i>Secondary stem</i>	<i>Number of leaflets</i>	<i>Fill pod</i>	<i>100 seed weight</i>	<i>Harvest index</i>	<i>Grain yield</i>	<i>Seed weight per plant</i>	<i>Number of grain</i>
Emergence percentage	1													
Height	0.048	1												
Biomass	0.231	0.439	1											
Number of days to flowering	0.037	-0.201	-0.229	1										
Number of days to maturity	-0.061	-0.155	-0.039	0.350	1									
Primary stem	0.128	-0.089	-0.511*	0.078	0.551*	1								
Secondary stem	0.282	-0.556*	0.085	0.321	0.114	0.296	1							
Number of leaflets	0.422	0.194	0.627**	-0.096	0.087	0.165	0.126	1						
Fill pod	0.326	0.221	0.476	-0.299	0.081	0.236	0.333	0.613**	1					
100 seed weight	0.062	0.196	0.468	0.140	0.106	0.211	0.184	0.552*	0.407	1				
Harvest index	-0.21	0.276	-0.105	-0.258	-0.149	-0.291	-0.427	0.231	-0.063	0.145	1			
Grain yield	-0.171	0.154	-0.159	-0.141	-0.152	-0.235	-0.263	0.219	-0.051	0.159	0.948**	1		
Seed weight per plant	-0.190	0.069	-0.281	-0.061	-0.400	-0.446	-0.102	0.037	-0.095	0.256	0.819**	0.878**	1	
Number of grain	0.480	0.121	-0.023	-0.010	0.103	-0.116	-0.423	0.299	-0.106	0.050	0.036	-0.007	-0.137	1

\*\* And \* respectively significant at the 1% and 5% level

**Table 5 - Simple correlation coefficients between traits evaluated under applying drought stress**

<i>Traits</i>	<i>Emergence percentage</i>	<i>Height</i>	<i>Biomass</i>	<i>Number of days to flowering</i>	<i>Number of days to maturity</i>	<i>Primary stem</i>	<i>Secondary stem</i>	<i>Number of leaflets</i>	<i>Fill pod</i>	<i>100 seed weight</i>	<i>Harvest index</i>	<i>Grain yield</i>	<i>Seed weight per plant</i>	<i>Number of grain per plant</i>
Emergence percentage	1													
Height	0.015	1												
Biomass	0.426	0.288	1											
Number of days to flowering	-0.311	0.289	-0.178	1										
Number of days to maturity	-0.218	-0.149	-0.022	-0.081	1									
Primary stem	0.269	-0.130	0.463	-0.109	-0.005	1								
Secondary stem	0.052	-0.135	-0.060	-0.067	-0.053	0.137	1							
Number of leaflets	0.180	-0.087	0.298	-0.279	0.107	0.215	0.612**	1						
Fill pod	0.265	0.291	0.289	-0.073	-0.270	0.447	0.622**	0.380	1					
100 seed weight	-0.063	0.125	0.168	0.189	-0.009	-0.131	0.261	0.572*	0.056	1				
Harvest index	-0.233	0.156	-0.034	0.005	-0.101	-0.436	-0.214	0.020	-0.383	0.056	1			
Grain yield	-0.415	0.163	0.024	0.084	-0.205	-0.368	0.129	-0.008	-0.149	0.153	0.754**	1		
Seed weight per plant	-0.262	0.134	0.118	0.093	-0.192	-0.279	0.105	0.079	-0.179	0.214	0.808**	0.953**	1	
Number of grain per plant	0.204	0.041	0.375	-0.217	-0.147	-0.031	-0.260	-0.117	-0.299	0.062	0.393	0.327	0.397	1

\*\* And \* respectively significant at the 1% and 5% level

**Table 6 - Simple correlation coefficients between traits in both irrigated and dry land conditions**

<i>Traits</i>	<i>Emergence percentage</i>	<i>Height</i>	<i>Biomass</i>	<i>Number of days to flowering</i>	<i>Number of days to maturity</i>	<i>Primary stem</i>	<i>Secondary stem</i>	<i>Number of leaflets</i>	<i>Fill pod</i>	<i>100 seed weight</i>	<i>Harvest index</i>	<i>Grain yield</i>	<i>Seed weight per plant</i>	<i>Number of grain per plant</i>
Emergence percentage	1													
Height	0.038	1												
Biomass	0.377	0.383	1											
Number of days to flowering	-0.170	0.160	-0.136	1										
Number of days to maturity	-0.161	-0.293	0.031	0.136	1									
Primary stem	0.247	-0.186	0.631**	-0.090	0.493*	1								
Secondary stem	0.213	-0.392	0.092	-0.059	-0.110	0.164	1							
Number of leaflets	0.306	0.078	0.519*	-0.157	0.074	0.255	0.543*	1						
Fill pod	0.329	0.285	0.453	-0.269	-0.173	0.336	0.531*	0.592*	1					
100 seed weight	0.029	0.141	0.322	0.204	0.071	0.049	0.243	0.609**	0.270	1				
Harvest index	-0.218	0.221	-0.083	-0.117	-0.160	-0.376	-0.345	0.159	-0.264	0.114	1			
Grain yield	-0.302	0.164	-0.058	-0.077	-0.300	-0.364	-0.211	0.151	-0.205	0.164	0.905**	1		
Seed weight per plant	-0.238	0.157	-0.108	-0.032	-0.388	-0.463	-0.134	0.152	-0.207	0.232	0.894**	0.974**	1	
Number of grain per plant	0.363	0.165	0.176	-0.209	0.042	0.003	-0.314	0.160	-0.186	0.145	0.233	0.202	0.168	1

\*\* And \* respectively significant at the 1% and 5% level

**Table 7 - Indices of drought tolerance of cultivars**

<b>Indices</b>	<b>YSI</b>	<b>YPI</b>	<b>TOL</b>	<b>SSI</b>	<b>STI</b>	<b>GMP</b>	<b>MP</b>
<b>Cultivars</b>							
<b>1</b>	60.77	81.62	0.73	20.85	0.74	70.43	71.20
<b>2</b>	86.55	108.82	0.58	22.27	1.41	97.05	97.69
<b>3</b>	40.08	63.57	1.06	23.49	0.38	50.48	51.83
<b>4</b>	42.29	62.55	0.93	20.26	0.40	51.43	52.42
<b>5</b>	56.04	90.38	1.07	33.98	0.76	71.40	73.39
<b>6</b>	75.79	109.06	0.87	33.27	1.24	90.92	92.43
<b>7</b>	46.52	74.74	1.08	28.22	0.52	58.97	60.63
<b>8</b>	40.54	65.68	1.09	25.14	0.40	51.60	53.11
<b>9</b>	76.59	94.54	0.54	17.94	1.08	85.09	85.57
<b>10</b>	65.15	82.96	0.61	17.81	0.81	73.52	74.06
<b>11</b>	47.99	79.2	1.13	31.21	0.57	61.65	63.60
<b>12</b>	53.27	78.89	0.93	25.62	0.63	64.83	66.08
<b>13</b>	44.88	68.48	0.98	23.6	0.46	55.44	56.68
<b>14</b>	44.52	87.26	1.40	42.74	0.58	62.33	65.89
<b>15</b>	42.36	77.24	1.29	34.88	0.49	57.20	59.80
<b>16</b>	33.05	79.16	1.66	46.11	0.39	51.15	56.11
<b>17</b>	46.48	85.89	1.31	39.41	0.60	63.18	66.19

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