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SELECTION OF SURROGATES FOR DROUGHT RESILIENCE IN TEMPERATE MAIZE (*ZEA MAYS* L.)

NIDA YOUSUF, SHER AHMAD DAR[1], ZAHOOR AHMAD DAR[1], PARVAZE AHMAD SOFI, AIJAZ AHMAD LONE[1], ASIF BASHIR SHIKARI[2], SHAZIA GULZAR AND SHOWKAT AHMAD WAZA[2*]

Division of Genetics & Plant Breeding, SKUAST-K, Shalimar, Srinagar-190025, J&K, India

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Abstract

Drought is one of the major constraints affecting the economic yield of maize worldwide. Present study was carried out to select the surrogates for drought resilience in 70 maize landraces collected from diverse agro-ecologies of Kashmir Himalayas. Significant variation was observed among the genotypes for all the traits under well-watered and drought conditions. Due to the drought stress, the highest reduction was observed for the canopy temperature (175.18%), followed by root volume (69.77%), top root biomass (69.1%), shoot biomass (67.2%), bottom root biomass (53.75%), chlorophyll content (22.85 SPAD units) and shoot height (21.63%). The reduction was also recorded for other traits like shoot to total biomass ratio (2.70%), relative water content (13.42 %), cell membrane stability (17.33%) and rooting depth (19.86%). Root to total biomass ratio was found to increase in response to drought stress (7.69%). A positive significant correlation was observed between grain yield and root volume, top root biomass, bottom root biomass, rooting depth, root to total biomass, chlorophyll content, cell membrane stability, canopy temperature depression and relative water content. These can be used for selection of appropriate surrogates of drought tolerant genotypes. The landraces *viz.,* KD-L35, KD-L37, KD-L19, KD-L23, KD-L17, KD-L21, KD-L46, KD-L43, KD-L29, KD-L25 and KD-L38 showed promising performance under drought for most of the surrogates identified. The landraces selected can be used as sources of novel and/or favourable alleles to breed for climate resilient maize cultivars.

Introduction

Maize is one of the most versatile and promising crops having extensive adaptability under diverse agro-climatic conditions. In India, it is cultivated over an area of about 10.2 million ha with the production of about 26.2 million tonnes and a productivity of 2.6 tonnes ha^{-1} (GoI 2017). The productivity of maize in India is very low as compared to global average of 5.6 tonnes ha^{-1}. In Jammu and Kashmir, the crop is cultivated over an area of about 0.31 million ha with the production of about 0.52 million tonnes and productivity of 1.7 tonnes ha^{-1}. In Kashmir valley, 14.50 per cent of the maize area is irrigated and the remaining 85.5 per cent is rainfed (Ahangar *et al*. 2020). Maize requires 450-600 mm of water during its life cycle at critical stages of crop growth *viz.,* knee height stage, flowering stage (tasseling and silking) and grain filling stage (Aslam *et al.* 2015). Under valley conditions the crop is deficit of water as only 307 to 555 (mm) of precipitation is received during the critical stages of crop growth.

Among the various abiotic stresses affecting maize productivity, water shortage at critical growth stages is responsible for the major crop losses (Badr *et al.* 2020). Grain yield in maize is reduced due to water stress prior to silking, at silking and after silking, signifying that silking stage is the most crucial stage for water stress (Sah *et al.* 2020). In maize, grain yield reduction caused by drought ranges from 10 to 76 %, depending upon severity and stage of drought occurrence

*Author for correspondence: <sahmad777@gmail.com>. [1]Dryland Agriculture Research Station, SKUAST-K, Rangreth, Srinagar-191132, J&K, India. [2]Mountain Crop Research Station, Sagam/Khudwani, SKUAST-K, Anantnag-192124, J&K, India.

(Bano *et al.* 2015). Breeding for drought resilient maize serves as the most coherent approach to cope with the problems inflicted by water scarcity. Breeding for drought tolerance in maize is primarily aimed at identifying genotypes with optimal reproductive capacity and low yield loss under moisture-stress conditions (Dar *et al.* 2021).

Although there have been many efforts to elucidate the plant responses to water stress in maize, yet no significant improvement has been achieved due to complexity of drought phenomenon. Drought tolerance is a complex phenomenon encompassing various morphological, biochemical and physiological parameters (Ali *et al.* 2016) including a deeper root system and water-conserving shoot traits (Beebe *et al*. 2008). Therefore, it is important to spot the less complex traits related to drought stress which are highly associated with grain yield and have relatively high heritability (Bonea 2020). Besides, the above ground traits have been largely targeted while the root system is mostly unexploited, probably due to highly heterogeneous nature of root architecture (Clark *et al.* 2011). In the present study, a set of 70 maize landraces were used to quantify the effects of drought stress on root, shoot and physiological traits to assess the influence of these traits on reproductive success (grain yield) of the crop plants under water stress conditions.

Materials and Methods

In the present study a set of 70 landraces of maize collected from different agro-ecologies of Kashmir valley was used. The genotypes were evaluated for grain yield under field conditions at Dryland Agriculture Research Station (DARS) Budgam, SKUAST-K under rainfed conditions in an augmented block design. The experimental plot comprised of two rows of two metre length for each genotype with a planting geometry of 60 x 20 cm. The meteorological data, including minimum and maximum temperatures, relative humidity and rainfall were recorded throughout the experimental period from May to October during the year 2019. Soil moisture status of the field was monitored using tensiometer and it was observed that the soil was deficit of water during the critical stages of crop growth. Grain yield plant^{-1} was recorded on five randomly selected plants for all the 70 landraces.

The plants were grown in PVC root columns of dimensions 1.3 m height and 20 cm internal diameter in a completely randomized design (CRD) with two replications each for drought and irrigated treatments. Initially four seeds were sown after surface sterilization with 10 % NaOCl and subsequent rinsing in distilled water. After the plants reached the four-leaf stage, only two competitive plants per column were maintained. Drought was imposed at first fully expanded four leaf stage by withholding water in the drought treatment. However, the irrigated treatment was continuously supplied with appropriate amount of water. The roots and shoots were harvested after 48 days of sowing and the soil from each column was sieved to derive all possible root fractions for unbiased estimate of root biomass.

Under greenhouse conditions, the genotypes were evaluated for variation in root, shoot and physiological parameters to understand the effect of water stress on different traits. The data pertaining to root traits in greenhouse was analyzed through factorial CRD with genotypes and water regime as two factors using OPSTAT-1 developed by CCS HAU, Hisar, Haryana, India (Sheoran *et al.* 1998).

The roots were harvested, washed to remove sand and other impurities, dried in shade and weighed for root biomass fraction. Roots were cut into two equal sections to estimate the biomass allocation in different zones. Data on various parameters were recorded such as rooting depth (measured as length of the longest root), root and shoot fresh weight, shoot height, root biomass at top and bottom, root volume, shoot and root to total biomass.

Cell membrane stability (CMS) was estimated after four weeks of stress imposition using electrical conductivity according to the method of Sairam *et al.* (2002).

Chlorophyll content (CC) from the fully most expanded leaves from the top of a plant per replication per treatment was recorded after four weeks of stress imposition using SPAD meter (Hanstech, Model CL-01) and was expressed in terms of numerical SPAD value *i.e.* the absorbance of the leaf in the red and near far red regimes (Nepolean *et al.* 2012). The SPAD numerical value is proportional to the amount of chlorophyll present in the leaf.

Canopy temperature was measured at two stages viz., two- and four-week intervals, after imposition of stress, between 10 am -2 pm using a hand-held infrared thermometer (Fluke 68 Max, Fluke Corporation USA) inclined at 45 degrees. To calculate the canopy temperature depression (CTD), deviation of temperature of plant canopies from the ambient temperature (Air temperature - canopy temperature) was estimated.

Leaf relative water content (RWC) was also measured at two stages viz., two and four weeks after stress imposition from top most fully expanded leaves. Four leaves were taken from each replication from both water stressed and well-watered treatments and fresh weight, turgid weight and dry weight was calculated and expressed as percentage (Barrs and Weatherley 1962).

Results and Discussion

The grain yield under water deficit conditions in the field was found to be significantly lower than expected. The grain yield under drought was found to range from 41.50 to 11.87 g plant^{-1} with the mean value of 25.02 g plant^{-1}. The highest grain yield plant^{-1} was observed for the landrace KD-L17 (41.5 g plant^{-1}) followed by KD-L23 (39.75 g plant^{-1}), KD-L37 (39.62 g plant^{-1}), KD-L46 (38.96 g plant^{-1}), KD-L43 (37.00 g plant^{-1}), KD-L35 (35.09 g plant^{-1}), KD-L19 (32.98 g plant^{-1}), KD-L21 (g plant^{-1}), KD-L52 (31.53 g plant^{-1}) and KD-L26 (30.64 g plant^{-1}). The landraces evaluated for grain yield under water deficit field conditions were also used to compute the effects of drought stress on root, shoot and physiological traits under greenhouse conditions (Supplementary Table 1).

Under greenhouse conditions, highest value for shoot height under drought conditions was exhibited by KD-L23 (57.5 cm) followed by KD-L9 (42.5 cm) and KD-L70 (42 cm) with 21.15 cm as an average. Similarly, shoot biomass had a mean value of 22.71g with highest value in KD-L53 (65.6 g) followed by KD-L13 (65.5 g), KD-L 68 (56.5 g) and KD-L42 (50.35 g). For rooting depth, a mean value of 27.33 cm was recorded with highest value in KD-L35 (47.35) followed by KD-L19 (45.5cm) and KD-L25 (39.8cm). A mean value of 5.2 g was recorded for root biomass at top with highest value in KD-L43 (16.45g) followed by KD-L25 (15.55 g), KD-L35 (15.3 g) and KD-L19 (14.5g). KD-L37 had the highest root biomass allocation at bottom (10.11 g) followed by KD-L25 (9.6g), KD-L19 (8.6 g) and KD-L35 (8.7 g). Under drought conditions, KD-L23 (26.76cm^3) had the highest root volume followed by KD-L37 (25.89cm^3), KD-L46 (19.81 cm^3) and KD-L11 (19.4 cm^3). Shoot to total biomass had a mean value of 0.72 with highest value in KD-L48 (0.98) followed by KD-53 (0.951) and KD-L7 (0.946) in response to water stress. The highest value for root to total biomass was observed in KD-L25 (0.76) followed by KD-L43 (0.72), KD-L19 (0.68), KD-L21(0.67), and KD-L35 (0.67) under drought stress as compared to control (Fig. 1a-h).

Cell membrane stability is also used as a physiological parameter for the assessment of drought tolerance. Under drought conditions, it had a mean value of 59.46 % with highest value in KD-L17 (73.98%), followed by KD-L12 (71.21%), KD-L37 (71.06%) and KD-L59 (70.98%) (Fig. 2a). Similarly, SPAD values varied significantly under moisture stress conditions and it was found that KD-L69 (32.50 SPAD units), followed by KD-L10 (32 SPAD units), KD-L12 (31.44

SPAD units), KD-L23 (30.86 SPAD units), KD-L29 (30.83 SPAD units), LD-L37 (30.78 SPAD units) exhibited higher SPAD values among 70 maize landraces (Fig. 2b).

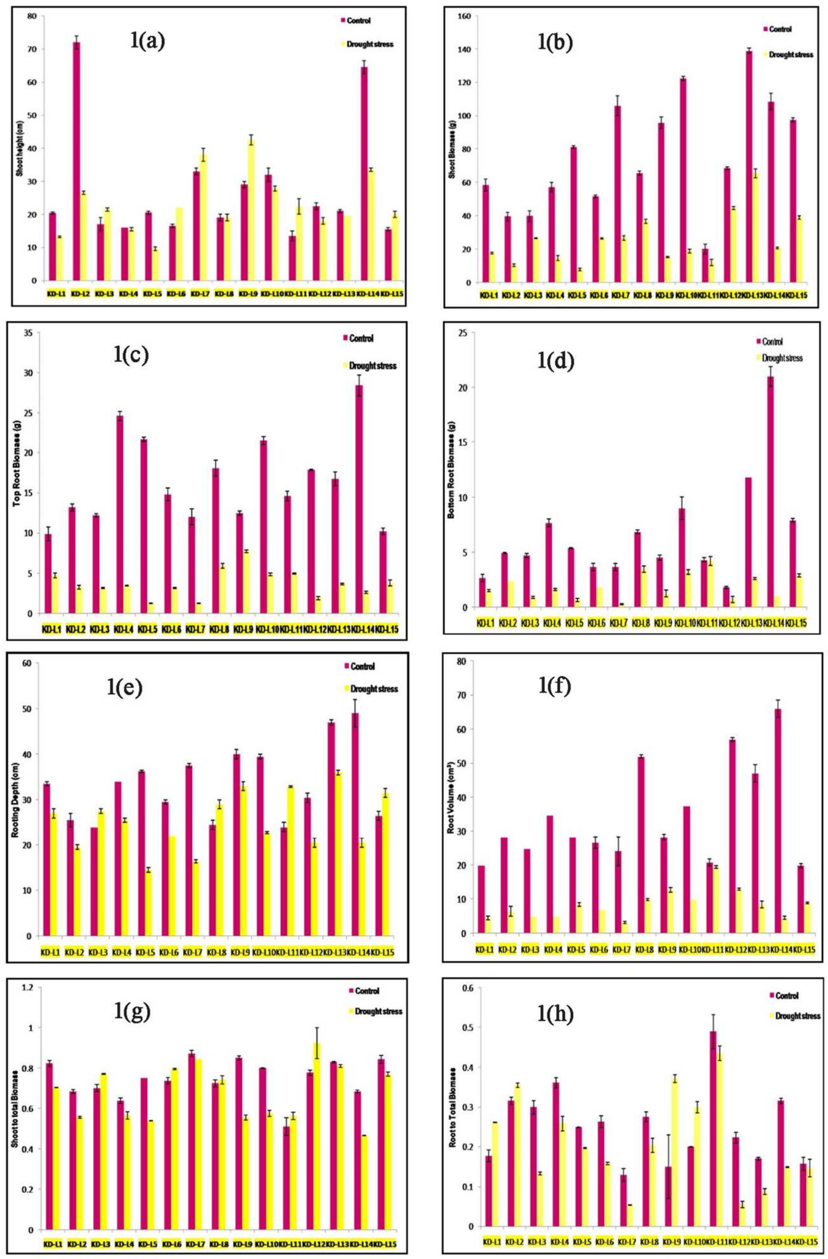

Fig. 1. Genetic variability for shoot and root traits. Interaction effect of drought and genotype on (a) shoot height (cm), (b) shoot biomass (g), (c) rooting depth (cm), (d) top root biomass (g), (e) bottom root biomass (g), (f) root volume (cm^3), (g) shoot to total biomass ratio and (h) root to total biomass ratio for some maize landraces. Vertical bars denote mean ± S.E. of means.

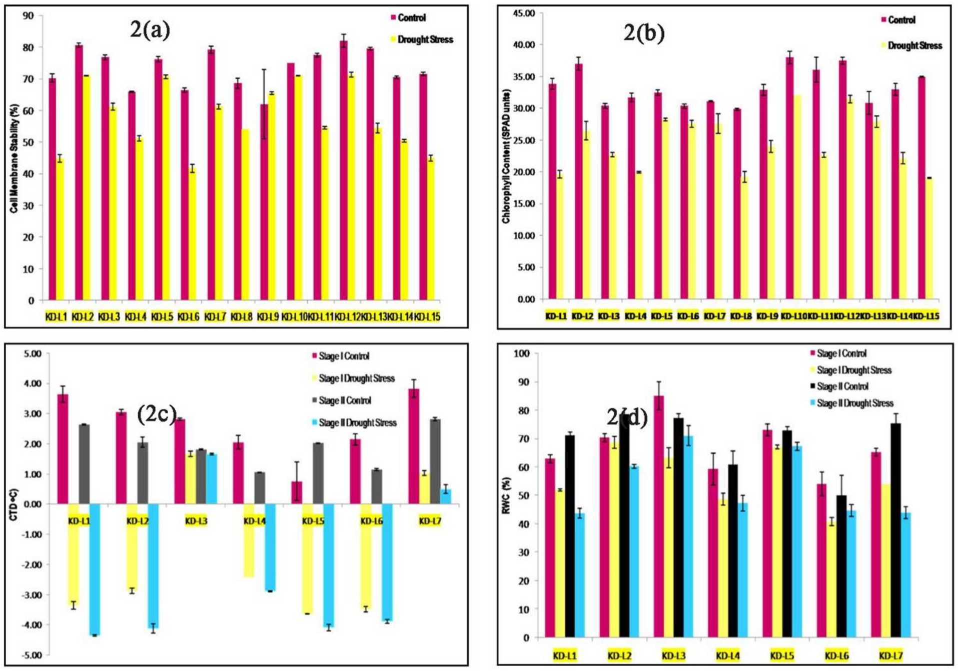

Fig. 2. Genetic variability for physiological traits. Interaction effect of drought and genotype on (a) Cell membrane stability (%), (b) Chlorophyll content (SPAD units), (c) canopy temperature depression (°C) and (d) Relative water content (%) for some maize landraces. Vertical bars denote mean ± S.E. of means.

The mean squares due to genotypes and water regime was significant for all the traits studied. The significance of main effects (genotypes and water stress treatments) indicated that the landraces performed differently and water stress treatments also significantly affected the plant traits. The first-degree interaction (Genotype x Water regime) was also found to be significant for all traits. The significance of interactions further implied that response to water deficit conditions by genotypes was also variable. The mean squares due to stages of measurement was also significant in case of CTD and RWC. The second degree (genotype x stage of measurement) and forth degree interaction (Genotype x water regime x stages of measurement) was also significant for CTD and RWC while as the third-degree interaction (water regime x stages of measurement) was significant for RWC only (Table 1a and 1b).

The significance of water stress treatments was revealed by considerable reduction in all root shoot parameters except root to total biomass under moisture stress condition (Fig. 1a-h). Among root shoot parameters evaluated, the highest percentage decrease was observed for root volume (69.77%), top root biomass (69.1%), shoot biomass (67.2%) followed by bottom root biomass (53.75%), and shoot height (21.63%) while as lowest per cent decrease was recorded in case of shoot to total biomass ratio (2.70%) and rooting depth (19.86%). However, root to total biomass ratio (7.69%) increased in response to drought stress compared to control. Increase in root to total biomass in the present study might be attributed to decrease in biomass allocation to shoot that may be advantageous to plant water wealth during drought stress because the reduction of aboveground portion accomplishes a characteristic response of plants to lessen drought stress *i.e.*, the reduction of transpiring surface. Despite of the decrease in root biomass at bottom, some of the landraces *viz.*, KD-L37, KD-L38, KD-L 35 and KD-L55 showed an extreme level of upsurge in root biomass at bottom under water stress conditions in comparison to control. Further, a slight increase in root volume was recorded in landraces KD-L23 and KDL-35. Similarly, KD-L50, KD-L11, KD-L63, KD-L41, KD-L19 and KD-L35 showed a greater degree of increase in rooting depth in comparison to overall decrease in the expression of the trait under water stress conditions

Table 1(a). Analysis of variance for main and interaction effects of root and shoot traits under greenhouse conditions in 70 maize (*Zea mays* L.) landraces.

Source of Variation	DF	Shoot height (cm)	Shoot biomass (g)	Rooting depth (cm)	Top root weight (g)	Bottom root weight (g)	Root volume (cm^3)	Shoot to total biomass	Root to total biomass
Genotypes	69	434.3*	1,139.2*	117.3*	45.80*	16.00*	338.9*	0.05*	0.04*
Water regime	1	2,388*	106,355*	3,213.7*	11,585.2*	1,143.2*	39,323.7*	0.003*	0.01*
Genotype x Water regime	69	264.8*	970.10*	94.40*	43.90*	16.40*	297.80*	0.01*	0.01*
Error	140	5	18.9	1.5	0.7	0.3	2.6**	0.00	0.00

*, Significant at 5 % level of significance.

Table 1(b). Analysis of variance for main and interaction effects of physiological traits under greenhouse conditions in 70 maize (*Zea mays* L.) landraces.

Source of variation	D.F.	CTD	RWC	Chlorophyll content (SPAD Units)	CMS
Genotypes	69	29.96*	577.48*	26.193*	118.502*
Water regime	1	80.61*	14,267.44*	4,065.94*	10,886.90*
Genotype x water regime	69	1.81*	168.59*	18.052*	52.23*
Stage of measurement	1	3,694.22*	21,893.25*	-	-
Genotype x stage of measurement	69	25.33*	226.20*	-	-
Water regime x stages of measurement	1	0.21	162.97*	-	-
Genotype x water regime x stages of measurement	69	2.26*	65.00*	-	-
Error	560	0.63	5.10	0.993	3.006

*, Significant at 5 % level of significance.

by 65.00, 36.87, 35.33, 34.41, 24.65 and 22.98 %, respectively suggesting that these landraces have genotypic ability to extract water from deeper layers of soil as a result of moisture depletion from top portion. The results were in close proximity with the findings of Islam *et al.* (2019) where rooting depth also did not show much decline and an increase in root shoot biomass ratio was observed under water stress conditions while as shoot biomass, root volume and root biomass showed a drastic decline. On the contrary, Aslam *et al.* (2014) reported that water stress caused a sharp decline in root biomass, root weight and root depth in maize. Dar *et al.* (2018) also screened maize genotypes for drought tolerance. The shift in root biomass to bottom exhibited by some landraces can compensate for water shortage. This might be due to the fact that one of the main challenges for plants under moisture stress conditions is to obtain more water from deeper layers due to rapid depletion of moisture from both plants as well as top soil by evaporative losses. In this case, the ability of the plant to adapt itself to develop profuse roots might be a vital mechanism to shun water scarcity and there is abundant proof that assimilates are shuffled to roots instead of shoots of rice as a response to drought stress (Kim *et al*. 2020). Therefore, it is imperative to breed for deep roots in maize as also confirmed previously (Ali *et al.* 2016). However, more critical thing would be selected for roots that use the same biomass more proficiently either through longer root hairs or greater root length.

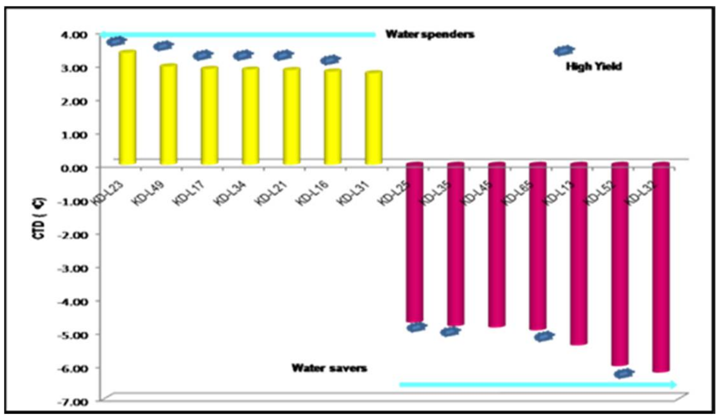

Fig. 3. Grouping of landraces into water savers and water spenders under drought stress.

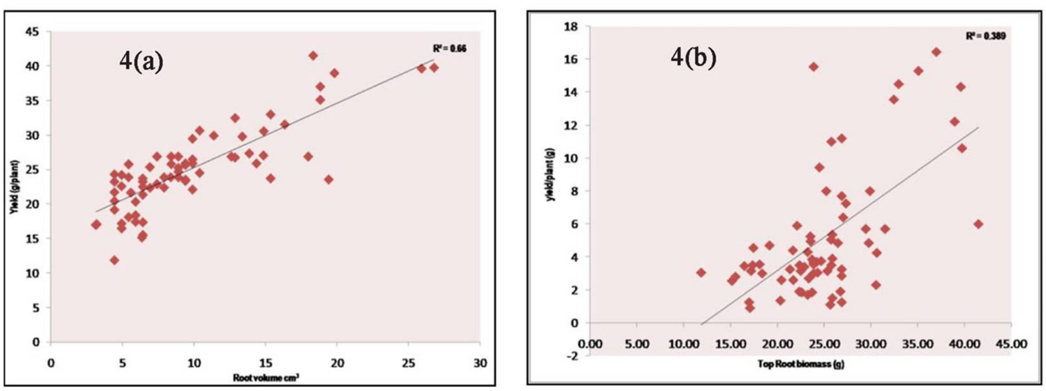

Fig. 4. Correlation of grain yield plant^{-1} (g) with (a) root volume (cm^3) and (b) top root biomass (g).

Across the 70 landraces, CMS showed a decline of 17.33% in response to moisture depletion (Fig. 2a). The decline in cell membrane stability observed was due to the fact that the moisture stress causes the enhanced production of reactive oxygen species which eventually ruptures cell membrane caused by lipid peroxidation (Sairam and Saxena 2000). The landraces having less than 50% CMS values are immensely susceptible to drought while landraces with 71–80% CMS values are considered to be drought resilient under water deficit conditions. Previous reports by Zenda *et al.* (2018) also support this finding. For chlorophyll content, there had been a decrease of 22.85 % across landraces under water stress conditions (Fig. 2b). Different studies also confirmed that the

Table 2. Correlation of grain yield with different shoot-root and physiological parameters in 70 maize (*Zea mays* L.) landraces of Kashmir.

	Yield (g/plant)	Shoot height (cm)	Shoot biomass (g)	Rooting depth (cm)	Top root biomass (g)	Bottom root biomass (g)	Root volume (cm)	Shoot to total biomass	Root to total biomass	CTD (° C)	RWC (%)	CMS (%)	Chlorophyll content
Yield (g/plant)	1.00												
Shoot height (cm)	0.16	1.00											
Shoot biomass (g)	-0.16	0.10	1.00										
Rooting depth (cm)	0.53**	0.01	-0.18	1.00**									
Top root biomass (g)	0.624**	-0.01	-0.37**	0.82**	1.00								
Bottom root biomass (g)	0.55**	-0.08	-0.32**	0.76**	0.89**	1.00							
Root volume (cm)	0.82**	0.28*	-0.14	0.54**	0.53**	0.44**	1.00						
Shoot to total biomass	-0.52**	0.05	0.66**	-0.69**	-0.89**	-0.84**	-0.50**	1.00					
Root to total biomass	0.52**	-0.05	-0.66**	0.69**	0.89**	0.84**	0.50**	-1.00**	1.00				
CTD (° C)	0.40**	0.09	-0.06	0.24*	0.24*	0.20	0.43**	-0.19	0.19	1.00			
RWC (%)	0.34**	-0.09	-0.20	0.37**	0.29*	0.31**	0.29*	-0.34**	0.34**	0.25*	1.00		
CMS (%)	0.47**	-0.05	-0.20	0.23	0.35**	0.29*	0.33**	-0.32**	0.32**	0.38**	0.55**	1.00	
Chlorophyll content	0.46**	0.06	-0.05	0.18	0.36**	0.35**	0.32**	-0.25*	0.25*	0.26*	0.12	0.48**	1.00

* and **, Significant at 5% and 1% levels of significance, respectively.

chlorophyll content of maize plants is noticeably affected under water deficit conditions (Guang-hua Yin *et al*. 2012, Ali *et al.* 2019). A major cause for decline in chlorophyll content due to water stress is oxidative burst, which results in lipid peroxidation and ultimately chloroplast structure deterioration (Kapoor *et al.* 2020).

Canopy temperature depression has emerged as a promising surrogate under moisture deficit conditions because considerable magnitude of natural variation exists in crops as well as due to its correlation with yield. Across all landraces, drought caused a drastic decline in CTD values by 152.81 and 206.94 % at stage-1 and stage-2, respectively. It was also observed that CTD values decreased progressively (175.18%) with a mean CTD value of -1.77 across stages on account of moisture depletion (Fig. 2c). Across stages (S1 and S2), CTD was found to be highest (3.36) in KD-L23 followed by KD-L49 (2.93). KD-L17 (2.87), KD-L34 (2.89) and KD-L21 (2.84) while as majority of the landraces experienced hotter canopies over air temperature. There was an increase in mean percent CTD change across stages for landraces KD-L31 (117.03%), KD-L16 (66.57%), KD-L29 (46.35%) KD-L49 (35.40%), KD-L23 (14.90%) and KD-L38 (7.17%). On the basis of sign of CTD values, the landraces can be grouped into water savers and water spenders (Fig. 3). The water spenders have higher stomatal conductance and lose water through transpiration, whereas water savers have conservative water use on account of lower stomatal conductance or early closure of stomata and as such have hotter canopies (Sofi *et al*. 2019).A strong positive association between grain yield of durum wheat and canopy temperature depression under moisture-stressed conditions was reported by Jokar *et al.* (2018) indicating that lines which maintained cooler canopies produced higher yields. Thus, it may be suggested that cooler canopy temperature (high CTD) is an indication of enhanced capacity of a plant to take up soil moisture. Similarly, relative water content that gives an idea of water retention capacity of a tissue showed a decline of 12.05 and 14.79 % at stage-1 and stage-2, respectively. Across stages (S1 and S2), RWC was highest in KD-L17 (79.29 %) followed by KD-L14 (72.75%), KD-L25 (71.96%), KD-L35 (70.5%), KD-L37 (70.16%) and KD-L19 (69.12%) with mean value of 58.83. The mean per cent reduction across two stages (S1 and S2) and across genotypes was 13.42 % (Fig. 2d) with highest mean reduction in KD-L7 (30.24%) followed by KD-L18 (29.15%), KD-L1 (28.50%) and KD-L15 (28.14%). Results revealed an increase in mean percent change across stages for landraces KD-L19 (9.5%), KD-L12 (6.55%), KD-L61 (3.01%) KD-L29 (2.3%) and KD-L35 (0.36%). Higher values of RWC values under water deficit conditions indicate that plant tissues are able to take up and/or hold more water than those tissues where RWC shows low values. Akshata and Mummigatti (2019) also reported that that RWC declined among all maize inbreds in response to water stress. Therefore, it is evident that the RWC can be used as an effective tool for screening genotypes with greater reliability.

A positive significant correlation (Fig. 4a and b, Table 2) was observed between grain yield recorded under field conditions with root volume (r^2 = 0.82), top root biomass (r^2 = 0.62), bottom root biomass (r^2 = 0.55), rooting depth (r^2 = 0.53), root to total biomass (0.52), chlorophyll content (r^2 = 0.46), cell membrane stability (r^2 = 0.47), canopy temperature depression (r^2 = 0.40) and relative water content (r^2 = 0.34) recorded under water stressed conditions in greenhouse for different landraces. However, shoot to total biomass had a significant negative correlation with grain yield plant^{-1} (r^2 = -0.52). Therefore, such traits particularly root volume and root biomass could be used as potential surrogates to supplement productivity under water deficit conditions.

Overall, the results of the study suggested that drought stress caused significant change in root architecture of temperate maize landraces. Root volume, top root biomass, bottom root biomass, rooting depth, root to total biomass, chlorophyll content, cell membrane stability, canopy temperature depression and relative water content were found to be associated with grain yield but root volume and root biomass could be used as more reliable surrogate for selection of drought tolerance in maize. The landraces KD-L35, KD-L37, KD-L19, KD-L23, KD-L17, KD-L21, KD-L46, KD-L43, KD-L29, KD-L25 and KD-L38 showed greater potential under drought conditions on the basis of different surrogates identified along with higher reproductive success. These landraces after further evaluation could be used as source for incorporation of drought tolerance into genetic background of commercial varieties.

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Supplementary Table 1. Grain yield plant^{-1} of 70 maize (*Zea mays* L.) landraces under field conditions.

S. No.	Landraces	Yield plant^{-1} (g)	S. No.	Landraces	Yield plant^{-1} (g)
1	KD-L1	19.17	36	KD-L36	23.25
2	KD-L2	21.36	37	KD-L37	39.62
3	KD-L3	17.20	38	KD-L38	26.89
4	KD-L4	16.49	39	KD-L39	25.89
5	KD-L5	26.89	40	KD-L40	25.76
6	KD-L6	25.37	41	KD-L41	22.60
7	KD-L7	16.99	42	KD-L42	15.54
8	KD-L8	22.12	43	KD-L43	37.01
9	KD-L9	26.89	44	KD-L44	23.72
10	KD-L10	26.48	45	KD-L45	20.34
11	KD-L11	23.57	46	KD-L46	38.96
12	KD-L12	26.75	47	KD-L47	18.39
13	KD-L13	23.89	48	KD-L48	17.09
14	KD-L14	21.72	49	KD-L49	27.04
15	KD-L15	24.69	50	KD-L50	25.24
16	KD-L16	29.78	51	KD-L51	22.90
17	KD-L17	41.50	52	KD-L52	31.53
18	KD-L18	22.51	53	KD-L53	30.56
19	KD-L19	32.98	54	KD-L54	15.16
20	KD-L20	11.87	55	KD-L55	29.91
21	KD-L21	32.46	56	KD-L56	25.67
22	KD-L22	22.36	57	KD-L57	23.89
23	KD-L23	39.75	58	KD-L58	17.45
24	KD-L24	23.37	59	KD-L59	17.37
25	KD-L25	23.89	60	KD-L60	20.45
26	KD-L26	30.64	61	KD-L61	23.72
27	KD-L27	25.78	62	KD-L62	22.39
28	KD-L28	25.89	63	KD-L63	27.34
29	KD-L29	25.90	64	KD-L64	23.54
30	KD-L30	26.89	65	KD-L65	23.25
31	KD-L31	25.79	66	KD-L66	18.12
32	KD-L32	21.67	67	KD-L67	24.31
33	KD-L33	29.46	68	KD-L68	24.52
34	KD-L34	26.89	69	KD-L69	24.22
35	KD-L35	35.10	70	KD-L70	23.89