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Stability analysis for yield and yield contributing characters in maize for different seasons at Rahuri

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Abstract
The experimental material comprised nine parental maize inbred lines, which were crossed in a full diallel mating system to produce 72 hybrids during the *rabi* 2020. In the present investigation, data were recorded on ten yield contributing quantitative traits. Estimation of stability of genotypes was described by three parameters *viz.*, mean performance, regression from the mean performance on environmental index (bi) and the function of squared deviation from regression (S^2di). Eberhart and Russel (1966) used the following model to study the stability of varieties under different environments. For stability analysis 72 hybrids with 9 parents along with 3 standard checks were used and stability analysis was carried for different characters over three different environments and results obtained are as under. Estimates of environmental indices (Ij) revealed that within all three environments, environment-3 was most favourable for yield contributing characters. The thirteen hybrids and one check *viz.*, IC-552819 x HYD-52212, HYD- 52212 x EC-639008, IC-470475 x HYD-52065, IC-470475 x HYD-52327, HYD-52327 x IC-472475, HYD-52184 x IC-552819, IC-552819 x HYD-52184, HYD-52184 x EC-639008, HYD-52065 x HYD-52327, HYD-52327 x HYD-52065, EC-639232 x HYD-52065, IC-552819 x IC-437070, IC-437070 x IC-552819 and check Parmeshwar.

Keywords: Yield, yield contributing characters, maize

Introduction

Maize is a monoecious and allogamous plant by nature. Being a C4 plant it is physiologically more efficient and possess higher grain yield potential. The capacity of any crop to perform well over a range of environments is as important as its yield potential and also its performance over a wide range of environmental conditions. Phenotypic stability parameters are useful to measure the adaptability and stability of crop cultivars which can be exploited to identify genotypes suitable for low, average and high yielding environments and to combat with climate change. The present investigation aims in identifying stable maize genotypes for further exploitation. (Patil *et al.* 2020) [10].

Stability of genotypes depends on maintaining certain morphological and physiological attributes steady and allowing others to vary, resulting in predictable G x E interaction for yield. Study of individual yield components can lead to simplification in genetic explanation of yield stability and hence are valuable to breeders in prediction and determination of the effects of the environments. Phenotype may be defined as a linear function of genotype (G), environment (E) and (G x E) interaction effect. Relative importance of main and interaction effects may vary from genotype to genotype and with environments. Thus, the study of G x E interaction serves as a guide and helps in identifying suitable genotypes for various environmental niches.

Several stability analyses have been proposed to determine linear relationship between genotypic performance and the environment. Eberhart & Russell (1966) [17] proposed a method in which the environmental index is the mean performance of all entries in an environment. The performance of each genotype is regressed on the environment to obtain its mean performance over all environments. A desirable genotype is one with high mean value, with regression coefficient of 1.0 and deviation from regression is 0. Such a genotype would have increased performance as the productivity of environment improves.

Materials and Methods

Nine inbred lines HYD-52212, IC-470475, HYD-52184, HYD-52065, HYD-52327, EC-

639232, IC-552819, EC-639008 and IC-437070 crossed in diallele fashion including reciprocal crosses during 2020-21 A field trial was conducted involving all the 72 single crosses, their 9 parents and three hybrids Permeshwar (Eco Agriseed Pvt. Ltd.), Rajashree and Phule Maharshri (MPKV, Rahuri) were used as standard checks during 25 June 2021, 25 August 2021 and 25 November 2021 in Randomized Block Design with three replications at AICRP on Maize, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India. The plot size was 4 m^2 and inter and intra row spacing was 75 × 20 cm. The observations were recorded on days to 50% tasseling, days to 50% silking, days to maturity, plant height, kernel rows per ear, kernels per row, 100 kernel weight, kernel weight per ear, kernel yield per plant. Data were recorded from five randomly selected plants from each block.

The data from three environment was used for this purpose. For each genotype stability was described by three parameters *viz*., mean performance, regression from the mean performance on environmental index (bi) and the function of squared deviation from regression (S2di). Eberhart and Russel (1966) [17] used the following model to study the stability of varieties under different environments.

Results and Discussions

Estimation of stability of genotypes was described by three parameters *viz*., mean performance, regression from the mean performance on environmental index (bi) and the function of squared deviation from regression (S^2di). Eberhart and Russel (1966) [17] used the following model to study the stability of varieties under different environments. For stability analysis 72 hybrids with 9 parents along with 3 standard checks were used and stability analysis was carried for different characters over three different environments and results obtained are as under. Estimates of environmental indices (Ij) are presented in Table 1, which revealed that within all three environments, environment-3 was most favourable for yield contributing characters.

Highly significant genotype x environment interaction was observed for all the characters indicating that all the hybrids interacted considerably well with the environmental conditions. Analysis of variance were significant for G + (G×E) among all the characters against pooled error and pooled daviation and indicated distinct nature of environment and GxE interactions in the phenotypic expression. Highly significant values for environment (linear) variance indicated considerable additive environmental variance for all the traits. Pooled deviations were also highly significant for the characters except for days to 50% tasselling, days to maturity and plant height which denoted that unpredictable portion formed the part of the GxE interactions.

Days to 50 percent tasseling

A perusal of data revealed that out of nine, one parent has non significant exhibited non-significant deviation from regression (S^2di), indicating their predictable behaviour for this traits. Among the nine parents, not single parent showed non-significant deviation from regression (S^2di) and regression coefficient greater than unity (bi >1) along with mean value higher than the population mean, thereby indicating their stability under favourable environments and suitability for early tasseling. One parental line *viz*., Hyd-52212 showed non-significant S^2di and regression coefficient nearly equal to unity (bi =1) with higher mean than the population mean. It thus indicated its stability under different environment for delayed tassiling.

The four hybrids *viz*; EC-639232 x HYD-52212, HYD-52212 x EC-63900, HYD-52184 x EC-639008 and check Parmeshwar showed non-significant S^2di and regression coefficient greater than unity (bi >1) with high mean value than the population mean, thereby indicating its stability under favourable environments and suitability for delayed tasseling i.e. shows below average stability. Eighteen hybrids *viz*., IC-470475 x HYD-52212, HYD-52184 x HYD-52212, HYD- 52212 x HYD-52065, HYD-52065 x HYD-52212, HYD-52327 x HYD-52212, HYD- 52212 x IC-437070, IC-437070 x HYD- 52212, IC-470475 x HYD-52184, IC-470475 x IC-437070, IC-437070 x IC-472475, HYD-52184 x HYD-52065, HYD-52065 x HYD-52184, HYD-52327 x HYD-52184, HYD-52184 x IC-437070, IC-437070 x HYD-52184, IC-437070 x HYD-52065, IC-437070 x HYD-52327 and check Rajashri exhibited non-significant S^2di and regression coefficient nearly equal to unity (bi =1) with lower mean than the population mean. It thus indicated their average stability under different environment for early tassiling. Four hybrids *viz*., HYD-52184 x HYD-52327, HYD- 52212 x IC-470475, HYD-52184 x IC-472475 and HYD-52327 x IC-437070 showed non-significant deviation from regression (S^2di) and regression coefficient (bi <1) along with mean value lower than the population mean, thereby indicating their above average stability under unfavourable environments and suitability for earlines. These results are in line with the reports of Lata *et al.* (2010) [6], Bisawas *et al.* (2014) [4], Shahryarinasab *et al.* (2015) [13], Serumaga *et al.* (2016) [12], Gami *et al.* (2017) [5], Sowmya *et al.* (2018) [14], Mebratu *et al.* (2019) [8], Pinto *et al.* (2019) [11].

Days to 50 percent silking

Stability parameters for this traits revealed that out of 72 crosses, 23 crosses exhibited non-significant deviation from regression (S^2di) and would show predictable behaviour for days to 50 percent silking.

Parental line IC-437070 exhibited non- significant S^2di and regression coefficient greater than unity (bi=1) with lower mean value than the population mean and would show average sensitivity to environmental fluctuations and adopted to all environments. Likewise parental line Hyd-52065 showed non-significant deviation from regression (S^2di) and regression coefficient greater than unity (bi >1) along with higher mean value than the population mean thereby indicating their stability under favourable environments and suitability for delayed silking.

Among hybrids three hybrids *viz*., EC-639232 x HYD-52212, EC-639232 x HYD-52184 and HYD-52184 x HYD-52327 exhibited non- significant S^2di and regression coefficient nearly equal to unity (bi =1) with lower mean than the population mean. It thus indicated their stability under different environments for early silking. Nine hybrids *viz*., HYD- 52212 x HYD-52184, HYD-52184 x HYD-52212, HYD-52065 x HYD-52212, HYD- 52212 x IC-437070, IC-437070 x HYD- 52212, HYD-52184 x IC-437070, IC-437070 x HYD-52184, HYD-52065 x IC-437070 and check Maharshi exhibited non- significant deviation from regression (S^2di) and regression coefficient less than unity (bi <1) along with mean value lower than the population mean, thereby indicating their stability under unfavourable environments and suitability for early silking. Hybrids HYD- 52212 x EC-639232, HYD- 52212 x EC-639008, EC-639008 x HYD-52212, IC-470475 x HYD-52065, HYD-52065 x IC-472475, HYD-52184 x EC-639232, EC-639008 x HYD-52184, IC-437070 x EC-639232, IC-552819 x IC-437070, EC-639008 x IC-437070 and IC-437070 x EC-639008 showed non-significant deviation from regression (S^2di) and regression coefficient greater than unity (bi >1) along with mean value lower than the population mean thereby indicating their stability under favourable environments and suitability for early silking. These findings are in accordance with Lata *et al.* (2010) [7], Bisawas *et al.* (2014) [4], Shahryarinasab *et al.* (2015) [13], Serumaga *et al.* (2016) [12], Gami *et al.* (2017) [5], Sowmya *et al.* (2018) [14], Mebratu *et al.* (2019) [8], Pinto *et al.* (2019) [11].

Days to maturity

Non-significant deviation from regression (S^2di) was depicted by 72 crosses, 1 cross indicating their predictable behaviour for days to maturity. Out of 9 parents no parent has significant deviation from regression.

Out of above nine parents, no parental line exhibited non-significant deviation from regression (S^2di) and regression coefficient greater than unity (bi >1) with lower mean value than the population mean and non- significant deviation from regression (S^2di) and regression coefficient less than unity (bi <1) along with mean value greater than the population mean, thereby indicating their stability under unfavourable environments and suitability for days to maturity.

Among the hybrid, EC-639232 x HYD-52184 exhibited non- significant deviation from regression (S^2di) and regression coefficient greater than unity (bi >1) with mean value less than the population mean. It thus indicated its stability under favourable environments for early maturity. Similar results were obtained in Lata *et al.* (2010) [7], Bisawas *et al.* (2014) [4], Shahryarinasab *et al.* (2015) [13], Serumaga *et al.* (2016) [12], Gami *et al.* (2017) [5], Sowmya *et al.* (2018) [14], Mebratu *et al.* (2019) [8], Pinto *et al.* (2019) [11].

Plant height

A perusal of data for this character revealed that out of 72 crosses, 24 crosses exhibited non-significant deviation from regression (S^2di), indicating their predictable behaviour.

Parent Hyd-52327 exhibited non- significant S^2di and regression coefficient nearly equal to unity (bi =1) with lower mean values than the population mean. This parents thus showed stability under different environments. Parent IC-552819 and EC-639008 exhibited non- significant S^2di and regression coefficient greater than unity (bi >1) with higher mean values than the population mean. Parent IC-470475 and EC-639232 exhibited non- significant S^2di and regression coefficient lower than unity (bi <1) with higher mean values than the population mean. This parents thus showed stability under different environments. Three hybrids IC-437070 x IC-552819, HYD- 52212 x IC-552819 and IC-552819 x EC-639232 exhibited non- significant S^2di and regression coefficient nearly equal to unity (bi =1) with higher mean values than the population mean. This hybrid thus showed stability under different environments.

Fifteen hybrids *viz*., IC-552819 x HYD-52212, IC-470475 x HYD-52327, HYD-52327 x IC-472475, IC-470475 x EC-639232, EC-639232 x IC-472475, EC-639008 x IC-472475, IC-552819 x HYD-52184, HYD-52065 x HYD-52327, HYD-52065 x EC-639232, EC-639232 x HYD-52065, EC-639008 x HYD-52065, HYD-52327 x EC-639232, EC-639232 x HYD-52327, EC-639008 x HYD-52327 and EC-639008 x IC-552819 exhibited non-significant deviation from regression (S^2di) and regression coefficient greater than unity (bi >1), with higher mean value than the population mean. These hybrids were considered stable for favourable environments.

Six hybrids *viz*., IC-470475 x HYD-52065, HYD-52065 x IC-472475, HYD-52184 x IC-552819, HYD-52327 x HYD-52065, IC-552819 x HYD-52065 and IC-552819 x IC-437070 exhibited non- significant deviation from regression (S^2di) and regression coefficient less than unity (bi <1) along with mean value lower than the population mean, thereby indicating their stability under unfavourable environments and suitability for plant height. The present findings are in agreement with Lata *et al.* (2010) [7], Anley *et al.* (2013) [2], Bisawas *et al.* (2014) [4], Shahryarinasab *et al.* (2015) [13], Abakemal *et al.* (2016) [1], Serumaga *et al.* (2016) [12], Gami *et al.* (2017) [5], Matin *et al.* (2017) [7], Synrem *et al.* (2017) [16], Sowmya *et al.* (2018) [14], Mebratu *et al.* (2019) [8], Nirmal *et al.* (2019) [9], Pinto *et al.* (2019) [11] and Arunkumar *et al.* (2020) [3].

Kernels row per ear

A perusal data for this traits revealed that out of 72 hybrids, 6 exhibited non-significant deviation from regression (S^2di), indicating stability and predictability for this trait.

Out of above nine parents, no parental line exhibited non-significant deviation from regression (S^2di) and regression coefficient greater than unity (bi >1) with lower mean value than the population mean and non- significant deviation from regression (S^2di) and regression coefficient less than unity (bi <1) along with mean value greater than the population mean, thereby indicating their stability under unfavourable environments and suitability for early maturity.

Only hybrids HYD-52065 x EC-639008 exhibited non-significant deviation from regression (S^2di) and regression coefficient nearly equal to unity (bi =1) with higher mean values than the population mean. Five hybrids *viz*., IC-55281 x IC-472475, IC-470475 x EC-639008, IC-552819 x HYD-52065, IC-552819 x HYD-52327 and HYD-52327 x EC-639008 exhibited non-significant deviation from regression (S^2di) and regression coefficient greater than unity (bi >1), with higher mean value than the population mean. These hybrids were considered stable for favourable environments. These hybrids were therefore considered suitable and stable in unfavourable environments. Anley *et al.* (2013) [2], Abakemal *et al.* (2016) [1], Matin *et al.* (2017) [7], Synrem *et al.* (2017) [16], Nirmal *et al.* (2019) [9] and Arunkumar *et al.* (2020) [3] also made similar observations confirming the present results.

Number of kernels per row

A perusal of data for this character revealed that out of 72 crosses, 3 crosses exhibited non-significant deviation from regression (S^2di), indicating their predictable behaviour.

Parental line *viz*., Hyd-52327 non- significant deviation from regression (S^2di) and regression coefficient lower than unity (bi<1) with higher mean values than the population mean.

One hybrid EC-639232 exhibited non- significant S^2di and regression coefficient nearly equal to unity (bi =1) with higher mean values than the population mean. This parents thus showed stability under different environments. The single hybrid *viz*., HYD-52065 x IC-472475 exhibited non-significant deviation from regression (S^2di) and regression coefficient equals to unity (bi =1), with higher mean value than the population mean. These hybrids were considered stable for favourable environments. Two hybrids *viz*., IC-470475 x HYD-52065 and HYD-52184 x IC-552819 exhibited non-significant deviation from regression (S^2di) and regression coefficient greater than unity (bi >1) with higher mean than the population mean. These hybrids thus showed stable for unfavourable environments. Similar findings were also made by Anley *et al.* (2013) [2], Abakemal *et al.* (2016) [1], Matin *et al.* (2017) [7], Synrem *et al.* (2017) [16], Nirmal *et al.* (2019) [9] and Arunkumar *et al.* (2020) [3].

Number of kernels per ear

A perusal of data for this character revealed that out of 72 hybrids, 24 hybrids exhibited non-significant deviation from regression (S^2di), indicating their predictable behaviour.

Parental lines Hyd-52327 and EC-639232 exhibited non-significant deviation from regression (S^2di) and regression coefficient less than unity (bi <1) with higher mean value than the population mean, thereby indicating their suitability and stability under unfavourable environments. One hybrid EC-639008 exhibited non- significant S^2di and regression coefficient nearly equal to unity (bi =1) with higher mean values than the population mean. This parents thus showed stability under different environments.

Fourteen hybrids *viz*., IC-470475 x HYD-52065, HYD-52065 x IC-472475, HYD-52327 x IC-472475, IC-470475 x IC-55281, IC-55281 x IC-472475, HYD-52184 x IC-552819, IC-552819 x HYD-52184, HYD-52327 x HYD-52065, HYD-52065 x IC-552819, HYD-52327 x IC-552819, EC-639232 x IC-552819, IC-552819 x EC-639008, EC-639008 x IC-552819 and check Parmeshwar exhibited non- significant deviation from regression (S^2di) and regression coefficient less than unity (bi <1) along with mean value lower than the population mean, thereby indicating their stability under unfavourable environments and suitability for number of kernels per ear. Similar results are tuned with Anley *et al.* (2013) [2], Abakemal *et al.* (2016) [1], Matin *et al.* (2017) [7], Synrem *et al.* (2017) [16], Nirmal *et al.* (2019) [9] and Arunkumar *et al.* (2020) [3] also made similar observations confirming the present results.

100-grain weight

Predictable behaviour was observed by 72 crosses out of 30 crosses. Out of above 9 parents, two parents *viz*., IC-552819 and EC-639008 exhibited non- significant S^2di and regression coefficient greater than unity (bi >1) with higher mean values than the population mean. One parent EC-639008 exhibited non- significant S^2di and regression coefficient nearly equal to unity (bi =1) with higher mean values than the population mean which shows thereby indicating their stability under unfavourable environments and suitability for 100 grain weight.

Fourteen hybrids *viz*., IC-470475 x HYD-52065, HYD-52065 x IC-472475, HYD-52327 x IC-472475, IC-470475 x IC-55281, IC-55281 x IC-472475, HYD-52184 x IC-552819, IC-552819 x HYD-52184, HYD-52327 x HYD-52065, HYD-52065 x IC-552819, HYD-52327 x IC-552819, EC-639232 x IC-552819, IC-552819 x EC-639008, EC-639008 x IC-552819 and check Parmeshwar exhibited non-significant deviation from regression (S^2di) and regression coefficient greater than unity (bi >1) with higher mean than the population mean. These hybrids thus showed stable for unfavourable environments. Three hybrid *viz*., EC-639232 x IC-472475, IC-552819 x HYD-52065 and IC-552819 x HYD-52327 exhibited non-significant deviation from regression (S^2di) and regression coefficient equals to unity (bi =1), with higher mean value than the population mean. These hybrids were considered stable for favourable environments. Seven hybrids *viz*., IC-470475 x HYD-52327, IC-470475 x EC-639232, HYD-52065 x HYD-52327, HYD-52065 x EC-639232, EC-639232 x HYD-52065, EC-639232 x HYD-52327 and IC-552819 x EC-639232 exhibited non- significant deviation from regression (S^2di) and regression coefficient less than unity (bi <1) along with mean value lower than the population mean, thereby indicating their stability under unfavourable environments and suitability for 100 grain weight. Lata *et al.* (2010) [7], Anley *et al.* (2013) [2], Bisawas *et al.* (2014) [4], Shahryarinasab *et al.* (2015) [13], Abakemal *et al.* (2016) [1], Serumaga *et al.* (2016) [12], Suthamathi and Nallathambi (2016) [15], Gami *et al.* (2017) [5], Matin *et al.* (2017) [7], Synrem *et al.* (2017) [16], Sowmya *et al.* (2018) [14], Mebratu *et al.* (2019) [8], Nirmal *et al.* (2019) [9], Pinto *et al.* (2019) [11] and Arunkumar *et al.* (2020) [3] also reported same results in their studies which endorsed the present investigation.

Kernel weight per ear

Non-significant deviation from regression (S^2di) was depicted by 38 crosses out of 72 crosses, thereby suggesting the predictability of performance of genotypes under reference for kernel weight per ear.

Parental line IC-470475 having non-significant deviation from regression (S^2di) and regression coefficient less than unity (bi <1) and higher mean values as compared to the population mean, was considered suitable and stable under unfavourable environments. The parent Hyd-52327 shows significant regression coefficient so that suitable for changing environments. Parent IC-552819 exhibited non-significant deviation from regression (S^2di), regression coefficient nearly equal to unity (bi=1) with higher mean values than the population mean. Parental line IC-552819 having non-significant deviation from regression (S^2di) and regression coefficient higher than unity (bi >1) and higher mean values as compared to the population mean, was considered suitable and stable under unfavourable environments. These hybrids were considered stable for different environments.

Twenty five hybrids *viz*., IC-470475 x HYD-52327, HYD-52327 x IC-472475, IC-470475 x EC-639232, EC-639232 x IC-472475, IC-470475 x IC-55281, IC-470475 x EC-639008, EC-639008 x IC-472475, HYD-52065 x HYD-52327, HYD-52327 x HYD-52065, HYD-52065 x EC-639232, HYD-52065 x IC-552819, IC-552819 x HYD-52065, HYD-52065 x EC-639008, EC-639008 x HYD-52065, HYD-52327 x EC-639232, HYD-52327 x IC-552819, IC-552819 x HYD-52327, HYD-52327 x EC-639008, EC-639008 x HYD-52327, EC-639232 x IC-552819, IC-552819 x EC-639232, EC-639232 x EC-639008, EC-639008 x EC-639232, IC-552819 x EC-639008 and EC-639008 x IC-552819 exhibited non-significant deviation from regression (S^2di) and regression coefficient greater than unity (bi >1) with higher mean than the population mean. These hybrids thus showed stable for unfavourable environments. Five hybrid *viz* HYD-52065 x IC-472475, IC-55281 x IC-472475, EC-639232 x HYD-52065, EC-639232 x HYD-52327 and IC-470475 x HYD-52065 exhibited non-significant deviation from regression (S^2di) and regression coefficient equals to unity (bi =1), with higher mean value than the population mean. These hybrids were considered stable for favourable environments. Eight hybrids *viz*., HYD- 52212 x IC-552819, IC-552819 x HYD-52212, HYD-52184 x IC-552819, IC-552819 x HYD-52184, HYD-52184 x EC-639008, IC-552819 x IC-437070, IC-437070 x IC-552819 and check Parmeshwar exhibited non- significant deviation from regression (S^2di) and regression coefficient less than unity (bi <1) along with mean value lower than the population mean, thereby indicating their stability under unfavourable environments and suitability for 100 grain weight. These findings are in line with Lata *et al.* (2010) [7], Anley *et al.* (2013) [2], Bisawas *et al.* (2014) [4], Shahryarinasab *et al.* (2015) [13], Abakemal *et al.* (2016) [1], Serumaga *et al.* (2016) [12], Suthamathi and Nallathambi (2016) [15], Gami *et al.* (2017) [5], Matin *et al.* (2017) [7], Synrem *et al.* (2017) [16], Sowmya *et al.* (2018) [14], Mebratu *et al.* (2019) [8], Nirmal *et al.* (2019) [9], Pinto *et al.* (2019) [11] and Arunkumar *et al.* (2020) [3] which enlightened the present outcome on grain yield per plant.

Kernel yield per plant

A perusal of stability parameters for kernel yield per plant revealed that out of 72 hybrids, 37 hybrids exhibited non-significant deviation from regression (S^2di) and are as such predictable for this trait.

Parental lines IC-470475, Hyd-52327 and EC-639008 having non-significant deviation from regression (S^2di) and regression coefficient less than unity (bi <1) and higher mean values as compared to the population mean, was considered suitable and stable under unfavourable environments. The parent EC-639232 shows significant regression coefficient so that suitable for changing environments. Parent IC-552819 exhibited non- significant deviation from regression (S^2di), regression coefficient nearly equal to unity (bi=1) with higher mean values than the population mean. Parental line IC-552819 having non-significant deviation from regression (S^2di) and regression coefficient higher than unity (bi >1) and higher mean values as compared to the population mean, was considered suitable and stable under unfavourable environments. These hybrids were considered stable for different environments.

Fourteen hybrids *viz*., IC-552819 x HYD-52212, HYD-52212 x EC-639008, IC-470475 x HYD-52065, IC-470475 x HYD-52327, HYD-52327 x IC-472475, HYD-52184 x IC-552819, IC-552819 x HYD-52184, HYD-52184 x EC-639008, HYD-52065 x HYD-52327, HYD-52327 x HYD-52065, EC-639232 x HYD-52065, IC-552819 x IC-437070, IC-437070 x IC-552819 and check Parmeshwar exhibited non-significant deviation from regression (S^2di) and regression coefficient less than unity (bi <1) with higher mean than the population mean. These hybrids thus showed stable for unfavourable environments. Four hybrid *viz*., IC-470475 x IC-55281, HYD-52065 x EC-639232, EC-639232 x IC-472475 and EC-639232 x HYD-52327 exhibited non-significant deviation from regression (S^2di) and regression coefficient equals to unity (bi =1), with higher mean value than the population mean. These hybrids were considered stable for favourable environments. Nineteen hybrids *viz*., HYD- 52212 x IC-552819, HYD-52065 x IC-472475, IC-470475 x EC-639232, IC-55281 x IC-472475, IC-470475 x EC-639008, EC-639008 x IC-472475, IC-552819 x HYD-52065, HYD-52065 x EC-639008, EC-639008 x HYD-52065, HYD-52327 x EC-639232, HYD-52327 x IC-552819, IC-552819 x HYD-52327, HYD-52327 x EC-639008, EC-639008 x HYD-52327, EC-639232 x IC-552819, IC-552819 x EC-639232, EC-639232 x EC-639008, EC-639008 x EC-639232 and EC-639008 x IC-552819 exhibited non- significant deviation from regression (S^2di) and regression coefficient greater than unity (bi >1) along with mean value lower than the population mean, thereby indicating their stability under unfavourable environments and suitability for 100 grain weight. These findings are in line with Lata *et al.* (2010) [7], Anley *et al.* (2013) [2], Bisawas *et al.* (2014) [4], Shahryarinasab *et al.* (2015) [13], Abakemal *et al.* (2016) [1], Serumaga *et al.* (2016) [12], Suthamathi and Nallathambi (2016) [15], Gami *et al.* (2017) [5], Matin *et al.* (2017) [7], Synrem *et al.* (2017) [16], Sowmya *et al.* (2018) [14], Mebratu *et al.* (2019) [8], Nirmal *et al.* (2019) [9], Pinto *et al.* (2019) [11] and Arunkumar *et al.* (2020) [3] who enlightened the present outcome on grain yield per plant.

Table 1: Environmental index (I) for different characters of maize

Sr. No.	Characters	Environment-I	Environment-II	Environment-III
1.	Days to 50% tasselling	-0.09	0.09	-0.09
2.	Days to 50% silking	0.09	0.03	-0.02
3.	Days to maturity	-0.06	0.16	-0.10
4.	Plant height (cm)	0.06	-0.22	0.26
5.	Number of kernel rows	0.01	-0.08	0.07
6.	Number of kernels per row	0.12	-0.20	0.18
7.	Number of kernels per ear	-0.08	-1.45	1.53
8.	100 grain weight (g)	0.05	-0.24	0.18
9.	Kernel weight per ear (g)	0.03	-0.19	0.19
10.	Kernel yield per plant (g)	0.07	-0.22	0.14

Table 2: Analysis of variance for stability parameters maize

Sr. No.	Character	Genotype (G)	Environment (E)	E+(G×E)	(G × E)	Environment (L)	(G × E) (L)	P.D	P.E
	Degree of freedom	83	2	168	166	1	83	84	498
1	Days to 50% tasselling	$71.8^{**@@++}$	0.29^{++}	$1.44^{@@++}$	$1.46^{@@++}$	0.59^{+}	$2.64^{@@++}$	0.26^{++}	0.11
2	Days to 50% silking	$58.74^{**@@++}$	0.42^{++}	$0.68^{@@++}$	$0.68^{@@++}$	0.85^{++}	$0.97^{@@++}$	0.39^{++}	0.06
3	Days to maturity	$74.37^{**@@++}$	2.07^{++}	$1.98^{@@++}$	$1.98^{@@++}$	$4.15^{@++}$	$3.27^{@@++}$	0.69^{++}	0.03
4	Plant height (cm)	$1985.32^{**@@++}$	6.97^{++}	3.40^{++}	3.36^{++}	$13.95^{@++}$	3.26^{++}	3.41^{++}	0.95
5	Number of kernel rows	$5.15^{**@@++}$	0.73^{++}	$0.83^{@++}$	$0.84^{@++}$	1.46^{++}	$1.07^{@@++}$	0.60^{++}	0
6	Number of kernels per row	$127.26^{**@@++}$	$4.28@^{++}$	$1.50^{@++}$	$1.47^{@++}$	$8.56^{@@++}$	$1.92^{@@++}$	1.01^{++}	0.07
7	Number of kernels per ear	$52469.34^{**@@++}$	186.26^{++}	80.61^{++}	79.34^{++}	372.52^{++}	62.79^{++}	94.75^{++}	39.62
8	100 grain weight (g)	$57.79^{**@@++}$	$4.02^{@@++}$	$1.79^{@@++}$	$1.76^{@@++}$	$8.04^{@@++}$	$3.03^{@@++}$	0.49^{++}	0.04
9	Kernel weight per ear (g)	$2309.88^{**@@++}$	3.25	3.76^{++}	3.77	6.5	4.08^{++}	3.41^{++}	2.24
10	Kernel yield per plant (g)	$4648.71^{**@@++}$	3.28	6.35^{++}	6.39	6.57	6.79^{++}	5.92^{++}	2.74

@,@@- Significance at 0.05 and 0.01 respectively when tested against G×E
*,**- Significance at 0.05 and 0.01 respectively when tested against P.D
+,++- Significance at 0.05 and 0.01 respectively when tested against P.E

Table 3: Stability parameters for characters days to 50% tasseling, days to 50% silking and days to maturity

Sr. No.	Genotype	Days to 50% tasselling			Days to 50% silking			Days to maturity		
		Mean	Bi	S^2di	Mean	Bi	S^2di	Mean	bi	S^2di
1	HYD- 52212 x IC-470475	68.16	1	-0.08	70.81	1.04	0.51**	107.70	-3.47	0.9**
2	IC-470475 x HYD-52212	68.47	-1.71	-0.01	71.33	-0.17	0.24*	108.10	-4.78	0.9**
3	HYD- 52212 x HYD-52184	70.8	-24.22	0.41*	73.59	-10.32	-0.08	109.80	-7.77	0.4**
4	HYD-52184 x HYD-52212	71.09	-24.66	0.21	73.85	-9.66	-0.01	110.00	-8.31	0.3**
5	HYD- 52212 x HYD-52065	69.12	-6.45	-0.04	71.84	-2.25	0.35*	108.50	-6.55	0.4**
6	HYD-52065 x HYD-52212	69.97	-15.69	0.07	72.65	-4.49	0.19	109.20	-6.82	0.7**
7	HYD- 52212 x HYD-52327	67.22	-0.52	0.32*	69.63	0.09	0.23*	106.50	-0.81	0.9**
8	HYD-52327 x HYD-52212	67.67	-0.94	-0.07	70.05	2.56	0.57**	107.00	-1.65	0.9**
9	HYD- 52212 x EC-639232	65.41	28.32	2.45**	68.1	14.78	-0.03	103.80	12.82	2.3**
10	EC-639232 x HYD-52212	66.4	4.72	0.3	68.9	1	0.15	105.60	2.09	0.9**
11	HYD- 52212 x IC-552819	62.45	32.58	-0.01	65.66	15.87	0.17	101.70	14.25	0.4**
12	IC-552819 x HYD-52212	63.01	32.18	0	65.99	16.44	0.16	102.20	14.16	0.8**
13	HYD- 52212 x EC-639008	63.98	31.67	0.23	66.94	17.32	0.08	102.90	12.54	1.6**
14	EC-639008 x HYD-52212	64.34	31.33	0.48*	67.49	14.57	0.07	103.40	13.36	1.7**
15	HYD- 52212 x IC-437070	72.08	-34.94	0.1	74.42	-8.43	-0.06	110.80	-9.54	0.1*
16	IC-437070 x HYD- 52212	71.24	-25.21	0.08	74.03	-9.33	0.02	110.30	-8.19	0.2**
17	IC-470475 x HYD-52184	68.39	-2.78	-0.03	71.08	-0.84	0.44**	107.90	-4.06	1.0**
18	HYD-52184 x IC-472475	67.99	1	-0.07	70.47	1.63	0.64**	107.50	-2.79	0.8**
19	IC-470475 x HYD-52065	61.81	32.34	-0.01	65.01	10.07	-0.04	101.40	14.27	0.3**
20	HYD-52065 x IC-472475	61.56	28.12	0.03	64.84	8.31	-0.05	101.20	14.89	0.4**
21	IC-470475 x HYD-52327	60.45	13.42	-0.06	63.65	-1.35	0.42**	99.30	3.36	0.6**
22	HYD-52327 x IC-472475	60.96	21.62*	-0.11	63.99	-0.74	0.30*	99.80	3.35	1.3**
23	IC-470475 x EC-639232	59.28	4.08	-0.12	62.86	-3.42	0.62**	98.10	2.81	0.10
24	EC-639232 x IC-472475	59.8	7.35	-0.13	63.14	-1.45	0.56**	98.80	3.12	0.2**
25	IC-470475 x IC-55281	56.02	-24.54	0.04	59.96	-13.79	0.41**	95.20	-6.82	0.2*
26	IC-55281 x IC-472475	56.8	-24.34	-0.05	60.64	-9.56	1.12**	95.90	-5.49	0.10
27	IC-470475 x EC-639008	57.45	-18.1	-0.07	61.42	-4.95	0.63**	96.30	-5.39	0.01
28	EC-639008 x IC-472475	58.1	-16.83	-0.01	61.95	-2.12	0.62**	97.10	-3.07	0.01
29	IC-470475 x IC-437070	68.7	-2.47	0.06	71.53	0.05	0.37*	108.20	-5.03	1.0**
30	IC-437070 x IC-472475	68.3	-2.57	-0.07	71.01	-0.13	0.41**	107.80	-3.91	0.9**
31	HYD-52184 x HYD-52065	68.89	-4.19	0.05	71.65	-0.97	0.31*	108.30	-5.65	0.7**
32	HYD-52065 x HYD-52184	69.81	-14.27	0.18	72.29	-2.46	0.32*	109.10	-6.37	0.7**
33	HYD-52184 x HYD-52327	67.02	1	0.19	69.54	1	0.17	106.20	-0.47	1.3**
34	HYD-52327 x HYD-52184	67.51	-1.67	-0.01	69.86	0.99	0.31*	106.90	-1.52	1.1**
35	HYD-52184 x EC-639232	65.01	30.68	0.87**	68.01	14.03	-0.04	103.70	13.06	2.0**
36	EC-639232 x HYD-52184	66.34	4.71	0.35*	68.56	1	0.02	104.80	6.98	-0.10
37	HYD-52184 x IC-552819	62.2	32.65	0.2	65.52	14.99	0.24*	101.60	14.43	0.4**
38	IC-552819 x HYD-52184	62.8	32.07	0.05	65.87	15.96	0.22*	101.90	13.68	0.6**
39	HYD-52184 x EC-639008	63.77	32.08	0.08	66.71	16.74	0.42**	102.80	13.01	1.4**

40	EC-639008 x HYD-52184	64.26	31.69	0.49*	67.29	14.86	0.09	103.20	13.76	1.8**
41	HYD-52184 x IC-437070	71.19	-24.92	0.09	73.94	-9.71	0	110.20	-8.05	0.3**
42	IC-437070 x HYD-52184	71	-24.4	0.3	73.69	-10.01	-0.05	109.90	-8.26	0.4**
43	HYD-52065 x HYD-52327	60.77	18.48*	-0.12	63.82	-1.54	0.46**	99.60	2.64	1.1**
44	HYD-52327 x HYD-52065	61.17	23.99	-0.08	64.13	-0.33	0.34*	100.30	6.59	0.9**
45	HYD-52065 x EC-639232	59.45	5.89	-0.1	63.01	-1.74	0.43**	98.20	3.01	0.10
46	EC-639232 x HYD-52065	60	9.13	-0.13	63.28	-2.06	0.62**	99.00	2.63	0.5**
47	HYD-52065 x IC-552819	56.29	-25.56	-0.04	60.1	-12.79	0.42**	95.40	-6.26	0.2*
48	IC-552819 x HYD-52065	57.06	-18.96	-0.07	60.92	-6.98	0.52**	96.00	-5.70	0.10
49	HYD-52065 x EC-639008	57.71	-16.39	-0.08	61.6	-3.64	0.64**	96.40	-5.50	0.01
50	EC-639008 x HYD-52065	58.37	-12.77	-0.03	62.13	-2.92	0.72**	97.30	-2.37	0.00
51	HYD-52065 x IC-437070	70.2	-18.78	0.36*	72.87	-5.56	0.01	109.40	-7.24	0.5**
52	IC-437070 x HYD-52065	69.31	-8.57	0.02	71.99	-1.8	0.55**	108.70	-6.59	0.3**
53	HYD-52327 x EC-639232	58.91	-3.82	-0.09	62.7	-3.03	0.66**	97.70	-0.29	0.10
54	EC-639232 x HYD-52327	59.59	6.51*	-0.11	63.07	-1.35	0.48**	98.40	2.97	0.10
55	HYD-52327 x IC-552819	55.89	-25.52	0.12	59.78	-13.05	0.64**	95.10	-7.98	0.2*
56	IC-552819 x HYD-52327	56.69	-23.92	-0.06	60.47	-11.16	0.81**	95.70	-5.61	0.2*
57	HYD-52327 x EC-639008	57.33	-18.47	-0.07	61.3	-5.72	0.53**	96.20	-5.40	0.10
58	EC-639008 x HYD-52327	57.97	-16.07	-0.03	61.84	-3.05	0.81**	96.80	-4.74	0.10
59	HYD-52327 x IC-437070	67.76	1	-0.05	70.22	1.79	0.55**	107.20	-2.18	0.6**
60	IC-437070 x HYD-52327	67.34	-1.74	0.22	69.74	-0.3	0.19*	106.70	-1.05	0.9**
61	EC-639232 x IC-552819	55.73	-26.83	0.19	59.62	-13.35	0.36*	94.90	-8.42	0.3**
62	IC-552819 x EC-639232	56.57	-23.48	-0.06	60.39	-11.45	0.57**	95.60	-6.21	0.10
63	EC-639232 x EC-639008	57.13	-19.18	-0.07	61.1	-6.53	0.66**	96.10	-5.62	0.10
64	EC-639008 x EC-639232	57.81	-15.84	-0.07	61.68	-3.77	0.67**	96.60	-5.35	0.10
65	EC-639232 x IC-437070	66.58	1.9	0.43*	69.17	-1.23	0.33*	105.80	1.35	1.3**
66	IC-437070 x EC-639232	66.15	5.49	0.57*	68.14	14.7	-0.03	104.20	10.65	0.8**
67	IC-552819 x EC-639008	56.42	-25.58	-0.06	60.22	-12.28	0.62**	95.50	-6.49	0.2*
68	EC-639008 x IC-552819	55.54	-26.8	0.24	59.31	-12.3	0.31*	94.60	-8.69	1.1**
69	IC-552819 x IC-437070	63.23	29.29	0	66.1	16.71	0.2	102.40	14.27	1.0**
70	IC-437070 x IC-552819	62.63	31.32	0.08	65.76	15.81	0.27*	101.80	13.96	0.5**
71	EC-639008 x IC-437070	64.46	32.96	0.54*	67.62	14.83	-0.01	103.50	13.13	1.8**
72	IC-437070 x EC-639008	64.19	31.29	0.44*	67.05	17.56	0.08	103.00	12.71	1.8**
	Maharshi	70.61	-23.69	0.38*	73.24	-7.22	-0.05	109.60	-7.97	0.5**
	Parmeshwar	63.64	31.72	0.04	66.49	18.2	0.45**	102.60	13.41	1.6**
	Rajashri	69.51	-11.15	0.05	72.15	-2.08	0.58**	108.90	-6.17	0.4**
	Mean	63.63			66.71			102.70		
	S.E. ±	0.37			0.45			0.60		

* Significance at 0.05 probability level,** Significance at 0.01 probability level.

Table 4: Stability parameters of parents for characters days to 50% tasseling, days to 50% silking and days to maturity

Sr. No.	Genotype	Days to 50% tasselling			Days to 50% silking			Days to maturity		
		Mean	Bi	S^2di	Mean	Bi	S^2di	Mean	bi	S^2di
1	Hyd-52212	67.86	1.00	-0.09	70.35	1.36	0.58**	107.3	-2.53	0.91**
2	IC-470475	63.45	32.89	0.01	66.37	18.05	0.36*	102.5	13.85	1.51**
3	Hyd-52184	66.79	0.72	0.32*	69.35	-0.01	0.25*	106	0.76	1.41**
4	Hyd-52065	65.1	28.54	3.51**	67.79	14.93	-0.04	103.6	12.97	2.11**
5	Hyd-52327	62.08	32.58	0.14	65.25	13.22	0.08	101.5	14.88	0.31**
6	EC-639232	61.35	24.86	0.09	64.57	5.19	0.01	100.8	12.05	0.61**
7	IC-552819	58.64	-8.42	-0.03	62.51	-3.11	0.61**	97.5	-2.57	0.1
8	EC-639008	60.23	12.28	-0.14	63.47	-2.5	0.44**	99.1	2.89	0.51**
9	IC-437070	70.45	-22.05	0.29	73.08	1	-0.02	109.5	-7.56	0.41**
	Mean	57.59	102.4	0.27	60.27	48.13	0.03	92.78	44.74	0.1

Table 5: Stability parameters for characters plant height (cm), number of kernel rows and number of kernels per row

Sr. No.	Genotype	Plant height (cm)			Number of kernel rows			Number of kernels per row		
		Mean	Bi	S^2di	Mean	Bi	S^2di	Mean	bi	S^2di
1	HYD- 52212 x IC-470475	162.2	-0.74	-0.8	12.48	-4.21	0.64**	19.52	4.22	0.12
2	IC-470475 x HYD-52212	159.5	2.32	-0.8	12.39	-4.5	0.81**	18.68	5.24	-0.05
3	HYD- 52212 x HYD-52184	149.8	7.56	-1.1	11.89	-3.8	1.91**	16.19	6.44	0.04
4	HYD-52184 x HYD-52212	148.1	9.19*	-0.9	11.42	2.54	1.21**	15.8	5.78	-0.05
5	HYD- 52212 x HYD-52065	156.6	5.32	-0.9	12.3	-4.6	1.07**	17.83	6.94*	-0.06
6	HYD-52065 x HYD-52212	153.3	1.73	-0.9	12.14	-4.58	1.48**	16.75	7.27	0.01
7	HYD- 52212 x HYD-52327	169.4	-5.36	14.81**	12.72	-3.86	0.23**	20.57	5.03	0.63**
8	HYD-52327 x HYD-52212	166.2	-2.71	4.8*	12.6	-4.14	0.38**	20.04	4.56	0.22*
9	HYD- 52212 x EC-639232	176.3	-5.26	5.2*	12.93	-3.57	0.04*	22.73	2.1	3.07**
10	EC-639232 x HYD-52212	173.4	-9.65	11.41**	12.83	-3.75	0.09**	21.61	5.45	2.14**
11	HYD- 52212 x IC-552819	193.1	1	-0.3	13.55	-2.4	0.33**	27.77	-5.64	0.83**
12	IC-552819 x HYD-52212	189.7	1.51	-1	13.47	-2.57	0.29**	27.22	-5.84	0.94**
13	HYD- 52212 x EC-639008	183.7	-1.41	-0.8	13.22	-2.95	0.04*	25.33	-4.52	1.67**
14	EC-639008 x HYD-52212	179.3	-7.04	3.11*	13.1	-3.17*	-0.01	23.77	0.52	3.25**
15	HYD- 52212 x IC-437070	145.8	5.61	-1	10.53	14.82	0.37**	15.2	4.8	0.11
16	IC-437070 x HYD- 52212	146.5	7.69	-0.3	10.63	14.72	0.22**	15.48	5.37	-0.02
17	IC-470475 x HYD-52184	160.4	-0.99	-0.9	12.44	-4.32	0.73**	19.08	3.97	0.01
18	HYD-52184 x IC-472475	163	-1.59	-0.9	12.51	-4.18	0.58**	19.65	4.21	0.12
19	IC-470475 x HYD-52065	195.9	-0.39	-0.3	13.67	-2.24	0.54**	28.6	-3.93	-0.02
20	HYD-52065 x IC-472475	196.5	0.44	0.2	13.71	-2.05	0.64**	28.79	1	0.1
21	IC-470475 x HYD-52327	204.3	2.71	-0.7	13.87	-1.96	0.93**	30.67	-4.4	1.54**
22	HYD-52327 x IC-472475	200.2	2.71	-1	13.8	-2.21	0.81**	30.4	-4.59	1.14**
23	IC-470475 x EC-639232	210.7	3.69	-0.5	14.07	-1.34	1.26**	31.97	-2.32	1.65**
24	EC-639232 x IC-472475	207.9	6.26	-0.7	13.98	-1.74	1.09**	31.27	-3.73	2.31**
25	IC-470475 x IC-55281	228.1	7.21	11.01**	15.88	17.03	0.08**	34.79	1.82	0.92**
26	IC-55281 x IC-472475	221.9	1.15	4.51*	15.7	16.75*	0.01	34.07	0.55	0.47**
27	IC-470475 x EC-639008	217.6	0.28	5.91**	15.5	16.13*	-0.01	33.4	0.04	0.43**
28	EC-639008 x IC-472475	214.2	6.2	1.7	14.35	0.61	1.56**	32.58	-1.95	1.47**
29	IC-470475 x IC-437070	158.6	2.26	-0.8	12.37	-4.46	0.88**	18.46	4.9	-0.06
30	IC-437070 x IC-472475	161.7	-0.74	-0.4	12.47	-4.17	0.67**	19.21	4.01	-0.05
31	HYD-52184 x HYD-52065	157.6	4.35	-1.1	12.33	-4.54	0.99**	18.04	6.22	-0.05
32	HYD-52065 x HYD-52184	154.2	4.23	-1	12.18	-4.59	1.32**	17.13	6.67	0.05
33	HYD-52184 x HYD-52327	170.6	-6.22	13.91**	12.76	-3.82	0.16**	20.86	5.48	1.36**
34	HYD-52327 x HYD-52184	166.9	-2.27	12.61**	12.65	-4	0.32**	20.24	4.86	0.27*
35	HYD-52184 x EC-639232	177.6	-3.88	2.1	12.98	-3.4	0.01	23	1.08	3.49**
36	EC-639232 x HYD-52184	174.2	-8.41	7.81**	12.87	-3.66	0.07**	21.91	5.72	2.36**
37	HYD-52184 x IC-552819	193.8	-1.12	0.1	13.61	-2.34	0.41**	28.27	-4.08	0.03
38	IC-552819 x HYD-52184	190.8	2.47	-0.9	13.5	-2.52	0.31**	27.42	-5.67	0.97**
39	HYD-52184 x EC-639008	185.1	-0.61	-0.6	13.25	-3.04	0.05**	25.78	-6.71	1.36**
40	EC-639008 x HYD-52184	180.3	-7.45	7.41**	13.15	-3.09	0.01	24.55	-1.99	2.11**
41	HYD-52184 x IC-437070	147.3	7.72	-1.1	11.03	8.62	0.61**	15.68	5.48	-0.05
42	IC-437070 x HYD-52184	149	7.32	-0.8	11.82	-3.36	2.01**	16.01	6.21	0.03
43	HYD-52065 x HYD-52327	202.8	1.48	-0.1	13.84	-2.13	0.87**	30.51	-4.3	1.16**
44	HYD-52327 x HYD-52065	198.9	0.51	-0.9	13.76	-2.13	0.71**	29.81	-0.81	0.81**
45	HYD-52065 x EC-639232	209.7	4.89	-1.1	14.05	-1.45	1.28**	31.73	-3.03	2.56**
46	EC-639232 x HYD-52065	206.6	3.95	-0.7	13.95	-1.72	1.04**	31.08	-4.01	1.92**
47	HYD-52065 x IC-552819	227.2	8.22	17.01**	15.85	16.97	0.07**	34.62	1.51	0.48**
48	IC-552819 x HYD-52065	220.7	-1.56	1.01	15.62	16.27*	-0.01	33.94	0.23	0.39*
49	HYD-52065 x EC-639008	216.5	1.03	8.81**	15.46	1	-0.01	33.26	0.02	0.49**
50	EC-639008 x HYD-52065	212.7	5.33	-0.1	14.3	0.26	1.63**	32.46	-2.01	1.54**
51	HYD-52065 x IC-437070	152.2	3.12	-1	12.07	-4.28	1.59**	16.59	7.09	0.1
52	IC-437070 x HYD-52065	155.8	5.43	-0.2	12.26	-4.67	1.21**	17.65	7.83*	-0.06
53	HYD-52327 x EC-639232	211.4	4.89	-0.4	14.11	-1.07	1.29**	32.25	-2.15	1.31**
54	EC-639232 x HYD-52327	209.1	5.25	-1.1	14	-1.6	1.11**	31.49	-3.15	2.85**
55	HYD-52327 x IC-552819	229.3	6.11	4.41*	15.93	17.31	0.08**	34.99	1.77	0.79**
56	IC-552819 x HYD-52327	222.8	-0.1	4.21*	15.72	16.72*	0.01	34.17	0.86	0.58**
57	HYD-52327 x EC-639008	218.4	-1.6	6.91**	15.55	16.21*	-0.01	33.53	0.3	0.47**
58	EC-639008 x HYD-52327	214.9	5.07	2.2	14.5	2.37	1.39**	32.71	-1.63	1.26**
59	HYD-52327 x IC-437070	165.2	-2.09	2.4	12.56	-4.18	0.48**	19.89	4.53	0.26*
60	IC-437070 x HYD-52327	168.4	-4.36	10.31**	12.7	-3.92	0.24**	20.39	4.81	0.46**
61	EC-639232 x IC-552819	229.9	7.47	6.01**	16.02	17.6	0.11**	35.41	2.5	1.31**
62	IC-552819 x EC-639232	223.9	1	2.3	15.77	16.7	0.03*	34.35	1	0.41*
63	EC-639232 x EC-639008	219.2	-4.05	6.61**	15.58	16.08*	-0.01	33.7	0.26	0.49**
64	EC-639008 x EC-639232	215.9	2.8	5.91**	14.59	3.17	1.35**	32.94	-0.9	1.29**
65	EC-639232 x IC-437070	172.3	-8.3	12.91**	12.81	-3.83	0.11**	21.51	5.44	2.19**

66	IC-437070 x EC-639232	175.8	-4.77	6.61**	12.9	-3.72	0.06**	22.02	5.41	2.48**
67	IC-552819 x EC-639008	226.2	10.07	18.61**	15.82	16.96	0.06**	34.48	1.22	0.39*
68	EC-639008 x IC-552819	231.5	5.73	-0.6	16.11	18.56	0.09**	35.85	3.61	1.31**
69	IC-552819 x IC-437070	188.6	0.58	-0.9	13.41	-2.73	0.17**	26.96	-6.14	0.71**
70	IC-437070 x IC-552819	192	1	-1	13.52	-2.49	0.32**	27.71	-5.68	0.92**
71	EC-639008 x IC-437070	178.5	-5.15	2.6	13.04	-3.33	0.01	23.47	0.68	3.12**
72	IC-437070 x EC-639008	181.7	-4.67	1.2	13.21	-3	0.03*	24.88	-3.39	1.84**
	Maharshi	150.5	6.75	-1.1	11.95	-3.89	1.69**	16.28	6.58	0.04
	Parmeshwar	186.3	-2.23	-0.9	13.3	-2.94	0.07**	26.25	-5.69	0.34*
	Rajashri	155	4.68	-0.8	12.23	-4.81	1.26**	17.42	7.54	-0.03
	Mean	186.60			13.46			25.58		
	S.E. ±	1.30			0.55			0.71		

Table 6: Stability parameters of parents for characters plant height (cm), number of kernel rows and number of kernels per row

Sr. No.	Genotype	Plant height (cm)			Number of kernel rows			Number of kernels per row		
		Mean	Bi	S^2di	Mean	Bi	S^2di	Mean	bi	S^2di
1	Hyd-52212	163.8	-1.48	-0.8	12.53	-4.22	0.55**	19.76	4.29	0.24*
2	IC-470475	187.4	-1.4	-0.7	13.35	-2.76	0.11**	26.68	-6.26	0.67**
3	Hyd-52184	171.6	-6.87	11.71**	12.77	-3.89	0.16**	21.36	5.65	2.51**
4	Hyd-52065	178	-3.5	3.11*	13.03	-3.32	-0.01	23.29	0.41	3.54**
5	Hyd-52327	194.9	1	-0.5	13.65	-2.32	0.49**	28.51	-4.12	-0.05
6	EC-639232	197.5	0.83	-0.5	13.74	-2.06	0.69**	29.19	1	-0.05
7	IC-552819	212.3	6.21	0.01	14.22	-0.15	1.38**	32.36	-2.12	1.41**
8	EC-639008	205.3	3.09	0.1	13.9	-1.9	0.94**	30.84	-4.32	1.91**
9	IC-437070	151.5	4.02	-0.9	12.01	-4.3	1.73**	16.41	6.65	0.02
	Mean	166.23	1.9	-3.29	11.92	-24.92	-0.01	22.84	1.18	-0.08

Table 7: Stability parameters for characters number of kernels per ear, 100 grain weight (g) and kernel weight per ear

Sr. No.	Genotype	Kernels per ear			100 grain weight (g)			Kernel weight per ear (g)		
		Mean	Bi	S^2di	Mean	Bi	S^2di	Mean	bi	S^2di
1	HYD- 52212 x IC-470475	247	-0.32	27.5	23.11	-6.11	0.47**	60.87	-0.58	3.73
2	IC-470475 x HYD-52212	231.6	-0.32	-19.8	22.55	-5.74	1.67**	58.43	3.35	0.89
3	HYD- 52212 x HYD-52184	173.5	7.36	6.6	19.56	5.48	0.27**	48.65	4.99	0.3
4	HYD-52184 x HYD-52212	160.7	4.92	15.4	19.3	5.14	0.41**	46.71	1.39	-1.12
5	HYD- 52212 x HYD-52065	217.8	1.05	-29.7	21.96	-4.24	1.34**	56.44	3.84	-2.01
6	HYD-52065 x HYD-52212	196.3	5.34	-39.1	20.45	3.24	0.1	51.33	5.74	-0.97
7	HYD- 52212 x HYD-52327	289.3	5.21	6.9	24.11	-6.91*	-0.01	69.48	-12.13	-0.53
8	HYD-52327 x HYD-52212	264.9	-2.24	-23.2	23.62	-6.49	0.06	65.38	-3.91	5.99
9	HYD- 52212 x EC-639232	337.5	-0.67	71.8	25.2	-6.15	0.57**	79.1	-6	-2.07
10	EC-639232 x HYD-52212	313.7	9.44	-26.2	24.83	-6.46	0.47**	74.91	-11.34	5.94
11	HYD- 52212 x IC-552819	415.5	3.55	203.81*	27.83	-0.71	1.26**	96.73	-2.12	2.62
12	IC-552819 x HYD-52212	399.8	2.67	151.41*	27.33	-1.8	0.79**	93.06	-3.83	0.15
13	HYD- 52212 x EC-639008	376.4	-3.88	120.21*	26.32	-4.4	2.43**	87.96	-7.23	-0.72
14	EC-639008 x HYD-52212	361.9	-4.19	166.31*	25.76	-4.82	0.88**	83.94	-7.11	-0.56
15	HYD- 52212 x IC-437070	139	0.83	-39.9	18.72	4.93	0.84**	42.75	5.98	-1.78
16	IC-437070 x HYD- 52212	150	2.46	-24.2	18.97	5.27	0.65**	44.67	0.49	-0.87
17	IC-470475 x HYD-52184	238.2	-0.96	92.8	22.66	-5.79	1.58**	59.06	3.72	2.94
18	HYD-52184 x IC-472475	252.3	-1.59	10.2	23.23	-6.09	0.33**	61.78	1.22	5.84
19	IC-470475 x HYD-52065	429.9	2.3	-18.1	29.13	1	-0.02	99.82	1	4.21
20	HYD-52065 x IC-472475	431.9	2.16	-10	29.28	5.29	0.05	101.66	1	7.54*
21	IC-470475 x HYD-52327	453.4	-0.75	-39.8	29.76	5.99	0.1	107.33	4.05	5.57
22	HYD-52327 x IC-472475	442.3	2.02	-32.9	29.61	5.73	0.11	105.41	3.26	0.59
23	IC-470475 x EC-639232	487.6	-3.98	96.8	30.48	7.33*	-0.02	113.05	6.14	3.61
24	EC-639232 x IC-472475	468.1	1	15.4	30.12	6.59	0.01	110.48	4.56	1.11
25	IC-470475 x IC-55281	585.5	5.6	-37.2	33.3	6.28*	-0.03	131.97	14.95*	-2.3
26	IC-55281 x IC-472475	550.6	1.36	55.3	32.51	6.4	-0.02	126.15	1	2.43
27	IC-470475 x EC-639008	529.7	-3.78	314.41**	31.75	6.27*	-0.04	121.45	9.7	-2.32
28	EC-639008 x IC-472475	503.7	-2.59	243.51**	31.04	7.68*	-0.04	118.12	8.11*	-2.25
29	IC-470475 x IC-437070	228.7	0.12	-10	22.43	-5.49	1.61**	57.52	4.12	-0.2
30	IC-437070 x IC-472475	242.5	0.28	64.7	22.78	-6.09	1.54**	60.15	3.17	6.87*
31	HYD-52184 x HYD-52065	222.5	1.63	-12.3	22.06	-4.18	1.31**	56.9	3.5	-1.43
32	HYD-52065 x HYD-52184	202.9	3.81*	-39.9	20.89	0.41	0.31**	52.34	2.69	-0.89
33	HYD-52184 x HYD-52327	293.6	6.12	8.7	24.23	-6.99*	-0.03	70.58	-13.95	0.02
34	HYD-52327 x HYD-52184	275	-3.98	-35.1	23.69	-6.64	0.07	67.01	-7.33	7.42*
35	HYD-52184 x EC-639232	344.7	-2.63	69	25.28	-6.15	0.68**	80.62	-7.94	-0.1
36	EC-639232 x HYD-52184	327.1	3.96	-2.9	24.92	-6.22	0.44**	75.89	-12.55	0.95
37	HYD-52184 x IC-552819	420.1	3.54	79.2	28.28	1.01	0.69**	97.51	-2.44	2.12

38	IC-552819 x HYD-52184	402.8	3.59	201.71*	27.51	-1.46	0.89**	94.58	-6.72	1.25
39	HYD-52184 x EC-639008	380.3	-2.07	114.71*	26.62	-3.22	1.41**	89.17	-9.67	-1.35
40	EC-639008 x HYD-52184	366	-5.25	150.91*	25.99	-4.5	1.65**	85.26	-8.68	-1.38
41	HYD-52184 x IC-437070	155.7	3.68	30.7	19.18	5.2	0.44**	45.81	-0.52	-1.99
42	IC-437070 x HYD-52184	167	6.71	1.4	19.4	5.26	0.47**	47.84	5.49	-1.32
43	HYD-52065 x HYD-52327	450	-0.92	-39.8	29.65	5.84	0.12	106.59	5.02	3.35
44	HYD-52327 x HYD-52065	437.9	1.83	-39.9	29.5	5.57	0.09	104	3.64	2.56
45	HYD-52065 x EC-639232	480.8	-1.97	23.9	30.41	7.23*	-0.04	112.05	3.55	5.46
46	EC-639232 x HYD-52065	463.6	0.09	-22.6	29.96	6.19	-0.02	109.71	1	-0.2
47	HYD-52065 x IC-552819	580.7	8.1	-26.3	33.14	6.47*	-0.04	131.26	18.98	-1.89
48	IC-552819 x HYD-52065	545.7	1	65	32.23	6.84	0.02	124.17	3.28	-2.11
49	HYD-52065 x EC-639008	521.7	-5.22	237.21**	31.58	6.43*	-0.04	120.74	10.1	-2.33
50	EC-639008 x HYD-52065	499.7	-2.89	228.71**	30.91	8.25*	-0.04	116.76	5.05	-1.81
51	HYD-52065 x IC-437070	191.3	4.59	-38.2	19.97	5.74	0.01	50.64	5.48	-0.24
52	IC-437070 x HYD-52065	211.8	1.96	-36.8	21.58	-3.2	0.77**	55.42	3.62	-1.09
53	HYD-52327 x EC-639232	491	-3.25	148.21*	30.58	7.62*	-0.04	114.24	8.25	3
54	EC-639232 x HYD-52327	476	-1.06	35.7	30.19	6.71	0.04	111.39	1	3.6
55	HYD-52327 x IC-552819	589.8	4.02	-36.4	33.5	6.01*	-0.04	132.79	13.42	-2.35
56	IC-552819 x HYD-52327	557	1	81.5	32.71	6.33*	-0.04	126.57	3.11	4.14
57	HYD-52327 x EC-639008	535.3	-4.66	366.81**	31.91	6.35	0.01	122.49	3.36	-1.9
58	EC-639008 x HYD-52327	510.1	-3.43	226.21*	31.21	7.35*	-0.04	119.45	10.49	-2.35
59	HYD-52327 x IC-437070	261.3	-0.6	-5.9	23.5	-6.17	0.08	64.29	-1.59	3.84
60	IC-437070 x HYD-52327	278.5	-2.04	-37.4	23.83	-6.54	0.12	68.21	-9.08	2.64
61	EC-639232 x IC-552819	592.5	2.18	-28.8	33.63	6.08*	-0.04	133.5	13.23	-2.38
62	IC-552819 x EC-639232	563.4	-2.11	31.6	32.9	6.56*	-0.04	128.8	10.25	0.81
63	EC-639232 x EC-639008	539.4	-2.4	240.21**	32	1	-0.02	123.47	4.66	-2.3
64	EC-639008 x EC-639232	515.4	-4.42	155.51*	31.35	6.99*	-0.04	120.37	9.16	-2.33
65	EC-639232 x IC-437070	309.6	9.26	-26.1	24.55	-6.81*	-0.02	74.06	-11.91	8.69*
66	IC-437070 x EC-639232	331.3	1.44	56	25.06	-6.22	0.44**	77.83	-5.91	-1.09
67	IC-552819 x EC-639008	577.3	9.56	-27.8	33.06	6.36*	-0.04	130.66	19.84	-1.75
68	EC-639008 x IC-552819	597.1	1.11	-39.8	33.94	1	-0.03	135.01	7.68	-2.3
69	IC-552819 x IC-437070	396.6	3.77	163.21*	27.22	-1.68	0.75**	91.96	-4.44	4.04
70	IC-437070 x IC-552819	408.2	3.49	169.61*	27.68	-1.2	1.44**	95.85	-3.84	2.1
71	EC-639008 x IC-437070	358.5	-3.84	160.01*	25.64	-5.21	0.94**	82.62	-9.86	-0.93
72	IC-437070 x EC-639008	369.6	-6.09	175.61*	26.09	-4.61	1.82**	86.58	-4.95	0.28
	Maharshi	181.1	6.12	-26.1	19.65	5.62	0.24*	49.01	5.39	-0.15
	Parmeshwar	391.7	1.82	111.2	26.76	-3.05	1.44**	90.21	-6.4	0.4
	Rajashri	206.5	3.44	-28.2	21.21	-1.24	0.58**	53.9	6.94	0.52
	Mean	373.90			26.68			88.64		
	S.E. ±	6.90			0.50			1.31		

* Significance at 0.05 probability level,** Significance at 0.01 probability level.

Table 8: Stability parameters of parents for characters number of kernels per ear, 100 grain weight (g) and kernel weight per ear

Sr. No.	Genotype	Kernels per ear			100 grain weight (gm)			Kernel weight per ear (gm)		
		Mean	Bi	S^2di	Mean	Bi	S^2di	Mean	bi	S^2di
1	Hyd-52212	255.3	-1.16	32.7	23.34	-6.44	0.34**	63.12	0.62	6.01
2	IC-470475	394.9	3.42	179.11*	26.85	-2.92	1.57**	91.26	-5.74	3.56
3	Hyd-52184	301.9	7.07	-5.5	24.43	-6.84*	-0.02	72.81	-15.18	4.36
4	Hyd-52065	354.6	-2.84	117.51*	25.49	-5.7	1.11**	81.76	-8.46	1.21*
5	Hyd-52327	424.9	2.67	15.2	28.5	1.65	0.49**	98.42	1	4.26
6	EC-639232	435.9	1.9	-36.3	29.4	1	0.09	102.89	2.74	7.72*
7	IC-552819	494.3	-3.43	259.81**	30.78	8.19*	-0.04	115.44	6.59	-1.92
8	EC-639008	459.7	1	-34.3	29.88	6.09	0	108.31	1.47	8.64*
9	IC-437070	185.8	5.36	-23.2	19.76	5.51	0.15*	49.51	6.74	0.88
	Mean	367.47	13.99	-51.4	23.84	-0.81	0.03	78.35	-10.22	18.36

* Significance at 0.05 probability level,** Significance at 0.01 probability level.

Table 9: Stability parameters for character kernel yield per plant (g)

Sr. No.	Genotype	Kernel yield per plant (g)		
		Mean	bi	S^2di
1	HYD- 52212 x IC-470475	73.4	8.82	2.3
2	IC-470475 x HYD-52212	69.5	4.97	2.9
3	HYD- 52212 x HYD-52184	49.9	-2	50.61**
4	HYD-52184 x HYD-52212	48.2	0.62	43.71**
5	HYD- 52212 x HYD-52065	64.1	15.53	2.7
6	HYD-52065 x HYD-52212	58.4	15.64	6.1
7	HYD- 52212 x HYD-52327	85	2.22	-2.5
8	HYD-52327 x HYD-52212	79.5	-6.22	-2.7
9	HYD- 52212 x EC-639232	98.1	6.87	-2.1
10	EC-639232 x HYD-52212	93.7	8.52	-1.2
11	HYD- 52212 x IC-552819	120.9	-14.51*	-2.7
12	IC-552819 x HYD-52212	116.3	-11.88	2.8
13	HYD- 52212 x EC-639008	111	-10.44	0.1
14	EC-639008 x HYD-52212	106.4	-8.71	4.9
15	HYD- 52212 x IC-437070	44.9	8.12*	-2.8
16	IC-437070 x HYD- 52212	46.2	5.68	14.31*
17	IC-470475 x HYD-52184	71.1	6.01	8.81*
18	HYD-52184 x IC-472475	74.2	7.1	1.1
19	IC-470475 x HYD-52065	125	-18.93	-0.6
20	HYD-52065 x IC-472475	127.1	-15.98*	-2.6
21	IC-470475 x HYD-52327	136.5	-10.49	-2.3
22	HYD-52327 x IC-472475	133.9	-12.26	3.8
23	IC-470475 x EC-639232	147	7.69	-1.1
24	EC-639232 x IC-472475	142.5	1	-2.6
25	IC-470475 x IC-55281	173.4	1	2.3
26	IC-55281 x IC-472475	164.4	5.86	3.2
27	IC-470475 x EC-639008	155.5	8.57	-2.6
28	EC-639008 x IC-472475	150.4	5.16	-2.7
29	IC-470475 x IC-437070	67.3	4.2	8.81*
30	IC-437070 x IC-472475	72.4	5.87	6.1
31	HYD-52184 x HYD-52065	65.8	5.5	1.3
32	HYD-52065 x HYD-52184	59.9	15.07	10.71*
33	HYD-52184 x HYD-52327	86.4	3.53	-2.01
34	HYD-52327 x HYD-52184	81.3	-3.41	-1.5
35	HYD-52184 x EC-639232	100.2	1.38	-2.71
36	EC-639232 x HYD-52184	95.2	8.47	-2.51
37	HYD-52184 x IC-552819	122.2	-14.27	-1.3
38	IC-552819 x HYD-52184	118.5	-14.39	2.3
39	HYD-52184 x EC-639008	111.7	-11.07	-1.3
40	EC-639008 x HYD-52184	108	-12.39	4.7
41	HYD-52184 x IC-437070	47.6	6.5	22.31**
42	IC-437070 x HYD-52184	49	0.46	54.91**
43	HYD-52065 x HYD-52327	135.4	-11.23	-1.01
44	HYD-52327 x HYD-52065	131.8	-5.45	-0.6
45	HYD-52065 x EC-639232	145.4	1	-2.2
46	EC-639232 x HYD-52065	140.2	-4.77	-1.9
47	HYD-52065 x IC-552819	172.7	2.35	12.41*
48	IC-552819 x HYD-52065	163.2	6.46	3.01
49	HYD-52065 x EC-639008	154.3	8.45	-0.7
50	EC-639008 x HYD-52065	149.6	8.97*	-2.8
51	HYD-52065 x IC-437070	56.3	12.01	-0.1
52	IC-437070 x HYD-52065	63.1	16.18	6.5
53	HYD-52327 x EC-639232	147.6	8.97	-0.9
54	EC-639232 x HYD-52327	143.4	1	-2.7
55	HYD-52327 x IC-552819	173.8	3.87	1.4
56	IC-552819 x HYD-52327	166.1	8.55	2.4
57	HYD-52327 x EC-639008	158.5	8.96	1.6
58	EC-639008 x HYD-52327	151.8	7.47	-2.4
59	HYD-52327 x IC-437070	77.1	0.08	-1.6
60	IC-437070 x HYD-52327	83.7	-2.28	-0.1
61	EC-639232 x IC-552819	174	4.25	1.7
62	IC-552819 x EC-639232	167.3	10.32	-0.3
63	EC-639232 x EC-639008	160.5	8.49	-2.5
64	EC-639008 x EC-639232	153.6	6.38	-1.7
65	EC-639232 x IC-437070	91	14.83*	-2.8

66	IC-437070 x EC-639232	96.7	4.37	-2.7
67	IC-552819 x EC-639008	171.9	1.11	24.21**
68	EC-639008 x IC-552819	175.9	8.54	-1.6
69	IC-552819 x IC-437070	114.9	-16.56	-1.5
70	IC-437070 x IC-552819	119.7	-13.29	-2.5
71	EC-639008 x IC-437070	103.1	-5.58	-1.5
72	IC-437070 x EC-639008	109.6	-13.18	4.7
	Maharshi	53.4	9.63	13.01*
	Parmeshwar	112.7	-8.3	-2.3
	Rajashri	61.8	16.57	8.61*
	Mean	110.80		
	S.E. ±	1.70		

* Significance at 0.05 probability level, ** Significance at 0.01 probability level.

Table 10: Stability parameters of parents for character kernel yield per plant (g)

Sr. No.	Genotype	Kernel yield per plant (g)		
		Mean	**bi**	**S^2di**
1	Hyd-52212	75.3	5.55	1.8*
2	IC-470475	114.3	-16.7	0.1
3	Hyd-52184	89.3	11.8	2.2*
4	Hyd-52065	102	-6.06	-2.1*
5	Hyd-52327	123.3	-12.33	-1.7
6	EC-639232	129.4	1.00	-0.7
7	IC-552819	148.5	6.82	0.6
8	EC-639008	137.8	-8.37	-2.01
9	IC-437070	54.6	10.84	4.6*
	Mean	97.45	-7.45	2.79

Conclusion

In conclusion, the stability analysis of 72 maize hybrids across three environments has provided comprehensive insights into genotype-environment interactions. The results revealed significant genotype x environment interactions for all traits, confirming the substantial impact of environmental conditions on hybrid performance. The environment-specific performance indicated that some hybrids and parental lines demonstrated consistent stability, with variations in adaptability depending on traits like tasseling, maturity, and yield components.

Notable findings include that certain hybrids, such as EC-639232 x HYD-52212 and HYD-52184 x IC-552819, showed stable performance across diverse environments for traits like kernel weight per ear and kernel yield per plant. These hybrids are recommended for further breeding programs due to their reliable performance. The results align with previous studies, reinforcing the importance of considering genotype-environment interactions for optimizing crop performance and stability.

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