International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(5): 1462-1464

Received: 22-07-2019
Accepted: 24-08-2019

RS Sudan
Maize Research Station, SKUAST-J, Sansoo Rakh, Behind Sub Area Officer Mess, VPO Garhi, Udhampur, Jammu & Kashmir, India

Praveen Singh
Division of Plant Breeding and Genetics, FOA, SKUAST-Jammu, Jammu & Kashmir, India

Nisar Ahmad
Maize Research Station, SKUAST-J, Sansoo Rakh, Behind Sub Area Officer Mess, VPO Garhi, Udhampur, Jammu & Kashmir, India

Correspondence
RS Sudan
Maize Research Station, SKUAST-J, Sansoo Rakh, Behind Sub Area Officer Mess, VPO Garhi, Udhampur, Jammu & Kashmir, India

Stability analysis of grain yield and maturity in maize hybrids under mid hill conditions of North Western Himalayas

RS Sudan, Praveen Singh and Nisar Ahmad

Abstract
Fifteen Genotypes of maize were grown in experiment to study the effect of environment of the preference of genotypes as for as their grain yield was concerned. This study comprised of fifteen experimental hybrids and was grown for three successive growing seasons during *Kharif* 2104, 2015 and 2016. Significant genotype, genotype x environment and genotype + (genotype x environment) interactions in grain yield was indicative of variable performance of genotypes under different seasons. Out of 15 genotypes three genotypes UDMH 121, UDMH 114 and UDMH 128 could match the requirement of having average stable genotypes with an average yield of 70.35, 71.52 and 71.24 q/ha respectively. Remaining single cross hybrids seemed to be considerably influenced by Genotype x Environment interactions encountered at the tested locations and location specific selection has to be made while selecting a maize hybrid for a particular location. The study was carried out over the years and in future locations can be added to make more environment specific recommendations.

Keywords: Maize hybrid, grain yield, maturity, stability

Introduction
Maize (*Zea mays* L.) is the most versatile cereal crop as it is cultivated in wide range of agro-climatic conditions. Globally, it is cultivated in an area of 160 million hectares with total production of 850 million tonnes. In India, it is grown in an area of about 8.67 million hectares with an overall production of 23.68 million tonnes and productivity of 2564 kg/ha. In Jammu and Kashmir, the crop occupies an area of 0.31 million ha with productivity of 1.8 t/ha (Shazia, *et al*. 2017). It is mainly concentrated in mid hill zones of the Jammu region under rainfed condition. Maize is grown for food, feed and fibers and is an important source of protein (9-12%) with better cooking and taste qualities. It is highly cross pollinated crop and have maintained heterozygous balance in open population. It shows heterosis in recombinants, particularly when inbreds differing for many genes affecting yield or some other character of importance are used as parents. Eberhart and Russell (1966) provided a dynamic approach for studying and interpreting phenotypic stability from regression analysis. It enables selection of genotypes that may give reasonably stable performance over a range of environments.
A significant G x E interaction for a quantitative trait such as seed yield can seriously limit the efforts on selecting superior genotypes for improved cultivar development (Kang and Gorman 1989). G x E interactions become important when the rank of breeding lines gets changed over environments. This change in rank is called crossover G x E interaction (Baker, 1988).

Material and Methods
The study was conducted for three consecutive years i.e. 2014, 2015 and 2016 at Maize Research station, SKUAST-J, Udhampur (J&K) situated at North West Himalayan Region under rainfed conditions. Fifteen experimental single cross developed hybrids including two checks i.e. Kanchan 517 and Kanchan 612 were used as experimental material. The experiment was laid out in Randomized block design with three replications during the years. Each plot consisted of two rows with a row length of 4 meter. The distance between the rows was 60 cm and plant to plant distance was kept at 25 cm. The recommended package of practices for the crop was followed for all the cropping seasons. The Euberhart and Russel Model was computed using Windostat computer software and was used to investigate the nature of G x E interaction for grain yield flowering and maturity.

Results and Discussion

Pooled analyses of variance, for yield, flowering and maturity days in different hybrids, genotypes over locations are presented in table No. 1. The results revealed that there was significant difference among all the genotypes tested for three years i.e. 2014, 2015 and 2016 for all the three characters under studied. Tollenaar & Lee (2002) [9] reported significant differences among high-yielding maize hybrids for their yield stability. The mean sum of square of environments were also found significant. This indicates the significant amount of environmental variability present at the location. The environment and their interaction with genotypes were also found to be significant for all the characters under study. The pooled deviation was also found significant for all the three characters under study. This indicates that nonlinear component of GXE interaction was predominant. The significant differences among genotypes and G X E interaction for grain yield in maize have also been reported by Gamma and Hallauer (1980) [4], Jha *et al.* (1986) [5], Dass *et al.* (1987) and Singh *et al.* (1996) [8]. The three stability parameters *viz.*, mean (x̄), regression coefficient (bi) and deviation from regression line (S^2di) were estimated for all the three characters and thus the result, obtained are presented in the Table No. 2. For days to flowering, the general mean over all the three environments and genotypes was 50.511 days. Among all the genotypes 10 showed significant deviation from regression (S^2di) across environments, this indicates that none of these genotype were stable. Gama & Hallauer (1980) [4] detected significant hybrid x environment interaction for maize hybrids, while some were reported to be stable when

Table 1: Pooled analysis of variance for stability of yield, flowering and maturity in maize hybrids across environments.

Source of Variations	Df	Grain Yield	Days to flowering	Days to maturity
Rep within Env.	6	1.72052	2.703	5.703
Varieties	14	21.11973**	9.358**	12.572**
Env. + (Var.* Env.)	30	0.63267**	2.340**	5.846**
Environments	2	0.29904**	2.288**	5.355**
Var.* Env.	28	0.65650**	2.344**	5.882**
Environments (Lin.)	1	0.59808**	4.577**	10.711**
Var.* Env.(Lin.)	14	0.56409**	4.520*	11.401
Pooled Deviation	15	0.69898**	0.221**	0.338**
Pooled Error	84	0.75906	2.362	6.269
Total	44	7.15128	4.573	7.986

*significant at 0.05%, ** significant at 0.01%

Table 2: Stability parameters for yield, flowering and maturity in maize hybrids across environments

S. No.	Variety	Grain Yield			Days to flowering			Days to Maturity		
		Gen. M	S^2Di	βi	Gen. μ	S^2Di	βi	Gen. μ	S^2Di	βi
1	PHM-15	65.369	-0.823**	-2.285	50.889	-2.341**	-0.316	98.444	-6.173**	0.145
2	PHM- 17	66.359	-0.812**	-1.102	51.333	-2.279**	-1.602	98.778	-5.723	0.114
3	PHM -12	68.712	-0.474	6.580	50.667	-2.169	0.146	98.111	-4.195	-0.228
4	UDMH-116	69.526	4.781**	-3.599	49.444	-2.341**	0.316	95.778	-6.038	0.674
5	PHM-34	69.840	-0.642**	0.046	49.222	-1.867	-0.024	91.556	-6.232**	15.322
6	UDMH-101	71.798	-0.741**	4.226	45.333	-0.443	14.563	94.778	-6.232**	-0.322
7	UDMH-112	67.623	-0.625**	-0.346	50.667	-2.385**	0.000	98.667	-6.232**	0.000
8	UDMH-114	71.522	-0.494	7.247	51.111	-2.124	-0.340	98.333	-6.230**	0.965
9	UDMH-115	70.544	-0.557	6.848	50.333	-2.359**	-0.801	97.556	-6.180**	-0.176
10	UDMH-121	70.353	0.182	-1.081	51.000	-2.385**	0.000	98.667	-6.011	0.031
11	UDMH-122	70.633	-0.806**	3.653	51.000	-2.385**	0.000	98.778	-6.193**	-0.820
12	UDMH-124	70.644	-0.796**	-3.339	50.222	-2.383**	0.485	98.000	-6.187**	0.498
13	UDMH-128	71.243	-0.821**	1.435	53.778	-2.247	1.117	99.111	-6.232**	-0.322
14	Kanchan 517	64.222	-0.567	-1.227	51.667	-2.366**	1.456	98.667	-4.365	-1.058
15	Kanchan-612	64.078	-0.816**	-1.655	51.000	-2.385**	0.000	98.444	-6.180	0.176
General Mean		68.831			50.511			97.577		

Both stability parameters were considered. However, genotype UDMH-128 had non significant deviation from regression (-2.247) and the regression value (1.117) near to unity (1) showing non interactive and stable performance over the locations. But the mean value of this genotype for flowering (53.77) is higher than the general mean, which indicates late flowering genotype .The genotype PHM-12 also have none significant deviation from regression (-2.169) and had earliness for flowering (50.667) days is stable for specific environments as having regression value (0.146). The regression value less than one and deviation from regression approaching zero, indicating less sensitive to environmental changes and were better adopted to environmental changes. For days to maturity the general mean over all the environment and fifteen maize hybrid was 97.577 days. Among the genotypes nine genotypes showed significant deviation from regression (S^2di) across environments mean none of these genotypes were stable. However, the check variety Kanchan 517 showed non significant deviation from regression (-4.365) with regression value near to unity (-1.058) indicating their stability in a specific environment, but takes more number of days to maturity as compare to general mean . Similarly the genotypes UDMH-116 had less number of days (95.778) to maturity with regression value near to unity (0.67) and deviation from regression approaching zero indicating less sensitivity to the environmental changes and was stable over the environment. The other genotypes PHM-17, PHM-12, UDMH-121, and Kanchan-612 also showed less interaction to the environments. However, they take more number of days to maturity than the general mean (97.577).

The average value of the grain yield across the location was 68.831 qtls/ha. The highest grain yield producing genotype across the environment was UDMH 101 (71.798 qtls/ha) while the minimum grain yield producing genotypes were check varieties Kanchan -517(64.222 qtls/hac) and kanchan -612 (64.078 qtls/ha). Over the years four hybrids i.e. UDMH-114, UDMH-115, UDMH-121 and PHM-12 were found less interactive to the environment as indicated by their higher or at par mean yield, statistically unit regression and non significant deviation from regression value. Out of these UDMH-121 was found stable with regression value near to unity (-1.081), non significant deviation from regression (0.182) and very high mean performance (70.353) over general mean. Kang & Gorman (1989) and Vulchinokova (1990) also reported significant G x E interactions for different traits of maize.

The stable genotypes thus identified over the present locations can be recommended for cultivation after evaluation of the genotypes over more years and in future locations that will be added to make more environments specific recommendations.

References:

1. Baker RJ. Tests for crossover genotype x environment interactions. Canadian J of Plant Sci. 1988; 68:405-410.
2. Dass, S Singh, M Sarial AK, Aneja DR. Stability analysis in maize. Crop Improvement. 1987; 14:185-7.
3. Eberhart SA, Russel WA. Stability parameters for comparing varieties. Crop Sci. 1966; 6:36-40.
4. Gama EEG, Hallauer AR. Stability of hybrids produced from selected and unselected lines of maize. Crop Sci. 1980; 20(6):623-626.
5. Jha PB, Khera AS, Akhter SA. Stability analysis for grain development and yield in maize. Crop lmprovement. 1986; 13:15-9.
6. Kang MS, DP Gorman. Genotype x environment interaction in maize. Agron. J. 1989; 81 (4):662-664
7. Shazia G, Dar ZA, Lone AA, Khan MA, Bhat MA, Ali G, *et al*. Genetic Diversity in Maize (*Zea mays* L.) Inbred Lines from Kashmir, Int. J Pure App. Biosci. 2017; 5(1):229-235.
8. Singh Gyanendra, Singh Major, Bhutia DT, Awasthi RP. Stability analysis in maize under mid-hills of Sikki. Journal of Hill Research 1996; 9:65-8.
9. Tollenaar M, EA Lee. Yield potential, yield stability and stress tolerance in maize. Field Crop Res. 2002; 75:161-169.
10. Vulchinokova P. Stability of biological yield in some maize hybrids. Resteniev dni-Nauki. 1990; 27(1):93-99.