

Agricultural Innovation Program (AIP) for Pakistan

Assessment of agronomic performance of kernel Zinc fortified maize genotypes in Pakistan

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Introduction:

According to the National Nutrition Survey-2011, 47.6% of pregnant women, 41.3% of non-pregnant women and 39.2% of children are Zinc deficient in Pakistan. Zinc fortified maize can be an alternative approach to enhance dietary quality of vulnerable communities. However, the agronomic performance of these varieties should be better or at par with widely cultivated varieties for rapid adoption by farmers. Therefore, current study is focused on evaluation of agronomic performance of Zn enriched maize genotypes.

Materials and Methods:

- CIMMYT under the Agricultural Innovation Program (AIP) for Pakistan evaluated 10 Zn enriched genotypes against two commercial checks for agronomic performance at three different locations i.e. Arifwala, Islamabad and Sahiwal during spring 2016.
- Alpha-lattice incomplete block design with two replications of each entry was used for field layout.
- Standard agronomic practices were followed throughout the cropping season across all of three locations.
- Data were collected for days to 50% anthesis (AD), days to 50% silking (SD), anthesis silking interval (ASI), plant height (PH; cm), ear height (EH; cm), ear position, number of ears per plant, ear aspect, field weight (FW; kg) and grain yield (GY; t/h).
- Data were subjected to analysis of variance, correlation coefficients, summary statistics and multivariate AMMI biplot analysis.

Results:

- Significant differences were observed among genotypes across the locations for grain yield (Table-1). Location effects were higher contributors towards grain yield followed by genotype effects and interaction effects (Table-1).
- Genotypic and phenotypic correlations of grain yield with different agronomic traits were varying across the locations (Table-2) which dictates that different selections criteria to be followed across diverse locations. Positive, negative and no correlation of FW with grain yield is due to differences in the moisture percent of grains at harvesting which is adjusted at 12.5% for grain yield estimation (Table-2).
- Heritability of the grain yield was 0.798, 0.684 and 0.612 respectively at Sahiwal, Arifwala and Islamabad (Table-3).
- Mean values with respective standard deviations for all of the studied traits are presented in Table-4, indicating the variable performance for different traits across different locations.
- The minimum average yield was recorded at Arifwala (2.5 t/ha) and maximum yield was recorded at Sahiwal (8.3 t/ha). Genotypes 10, 1 and 8 were significantly high yielding by having 8.3, 6.9 and 6.4 t/ha respectively at Sahiwal location. Genotypes 4, 6 and 10 were statistically high yielding genotypes at Islamabad by having 7.4, 7.4 and 7.2 t/ha respectively as compared to checks. However, genotype 3 (5 t/ha) and 10 (4.5 t/ha) were at par with the check (genotype 11, 5 t/ha) though results were statistically insignificant at Arifwala station (Figure-1).

Table-1: Analysis of variance for different maize entries

	DF	Sum of Squares	Percent Contribution	Cumulative Percent	Mean Squares
Locations (L)	2	23.729	39.278	39.278	11.86**
Genotypes (G)	11	19.678	32.574	71.852	1.789**
L×G	22	17.005	28.148	100.00	0.772*
PC1	12	11.625	73.609	73.609	0.968**
PC2	10	4.1680	26.391	100.00	0.417**
PC3	8	0.0000	0.0000	100.00	0
Residuals	36	20.790	0.0000		0.578

Table -3: Different statistical parameters for grain yield across different locations

	Arifwala	Islamabad	Sahiwal
Heritability	0.684	0.612	0.798
Genotype Variance	0.113	0.456	0.468
Residual Variance	0.105	0.578	0.237
Grand Mean	2.258	3.646	3.150
LSD	0.803	1.529	1.144
CV	14.35	20.86	15.44

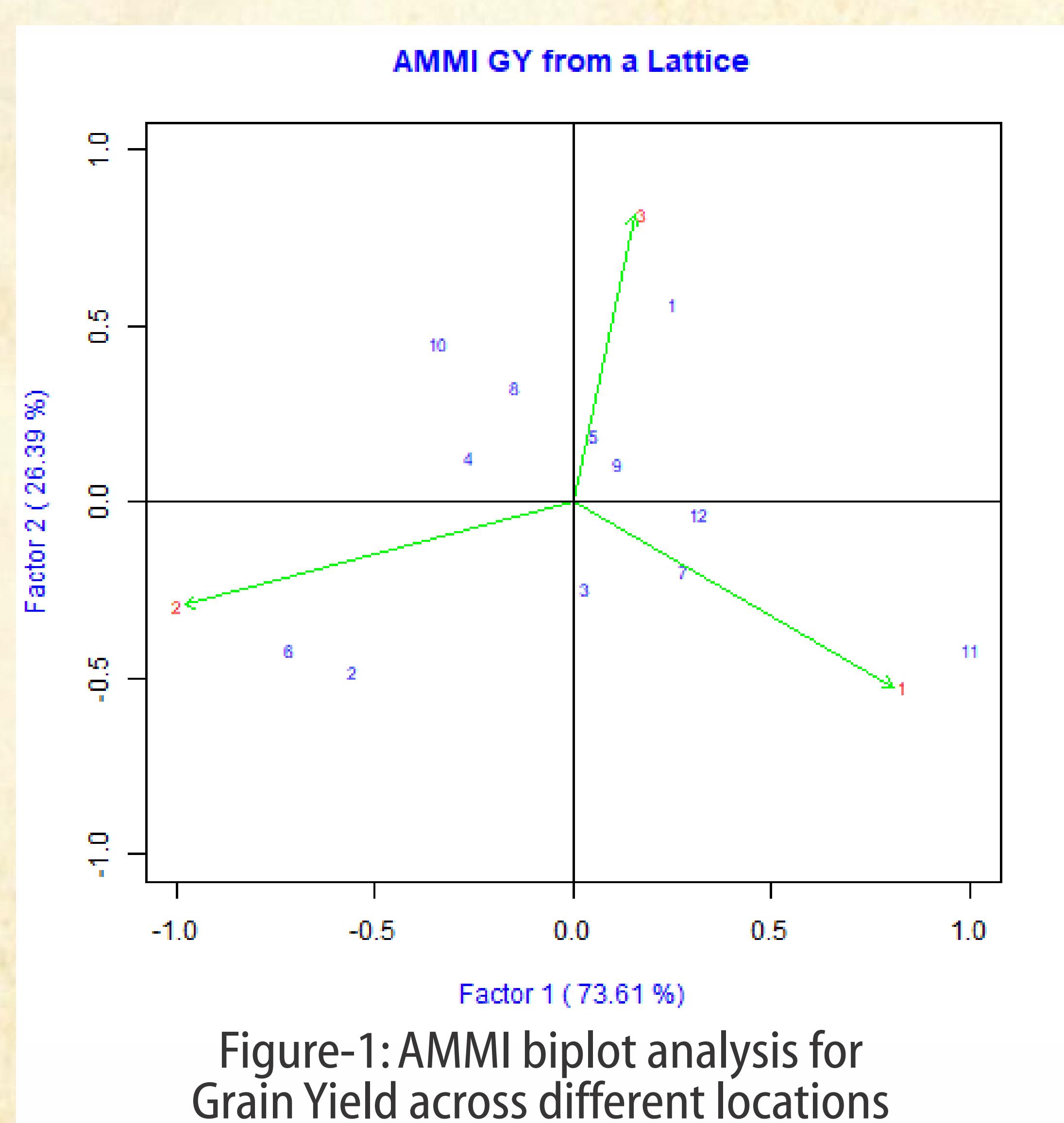


Figure-1: AMMI biplot analysis for Grain Yield across different locations

Table - 2: Genetic and Phenotypic correlation of different traits with grain yield (t/ha)

Traits	Arifwala		Islamabad		Sahiwal	
	Genotypic Correlation	Phenotypic correlation	Genotypic Correlation	Phenotypic correlation	Genotypic Correlation	Phenotypic correlation
EarAsp	0.998	0.998	0.998	0.997	0.974	0.997
EPP	NA	-0.158	NA	-0.637	-0.641	-0.467
EarPos	0.243	0.322	0.862	0.706	NA	-0.151
EH	0.999	-0.015	NA	0.429	0.611	0.321
PH	0.083	-0.044	-0.999	-0.271	0.474	0.061
ASI	-0.494	-0.003	NA	-0.369	-0.215	-0.435
Silking	NA	-0.025	-0.658	-0.301	0.213	0.174
Anthesis	0.633	0.019	-0.284	0.107	-0.843	-0.502
FW	NA	0.025	-0.147	0.197	-0.702	-0.438

Table -4: Means and standard deviations (SD) for different traits of maize genotypes

Location	Days to 50% Anthesis		Days to 50% Silking		Anthesis Silking Interval		Plant Height (cm)		Ear Height (cm)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Arifwala	57.83	1.58	59.83	1.61	2.00	0.42	234.96	22.59	129.67	12.77
Islamabad	83.37	2.49	86.29	2.63	2.92	0.77	232.83	21.00	101.35	5.77
Sahiwal	73.62	1.93	75.54	1.84	1.92	0.72	245.96	13.26	145.25	15.43
Location	Ear Position		Number of Ears Per Plant		Ear Aspect		Field Weight (Kg)		Grain Yield (t/h)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Arifwala	0.555	0.059	0.871	0.045	3.50	0.59	2.90	0.89	2.26	0.69
Islamabad	0.437	0.020	1.022	0.102	2.50	0.39	5.03	1.43	3.65	1.04
Sahiwal	0.590	0.047	1.056	0.056	2.94	0.65	4.11	1.32	3.15	0.97

Conclusions and Recommendations:

The results of this study indicates the selection potential of Zinc enriched maize for further testing and seed scale up in Pakistan.

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