Agricultural Innovation Program (AIP) for Pakistan

Open pollinated maize varieties: do they have scope in south Asia? Lessons from Pakistan

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Introduction:

The bulk (above 70%) of Pakistan's 6 million tons maize production comes from the Punjab province where farmers use predominately (90%) hybrid maize. However, hybrid covers about 30-40% of the maize area in Pakistan and farmers in the northern areas use open pollinated varieties (OPVs). Absolute replacement of OPVs with hybrids is not feasible due technical skills, resource limitations and financial constraints. Therefore, current study explored the grain yield potential of improved OPVs and their adaptation pattern at the different agro ecologies of Pakistan.

Materials and Methods:

- A total of thirty white grain maize OPVs including one best commercial check were subjected to agronomic evaluation across ten maize growing environments of Pakistan during spring
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- Evaluation trials were conducted on the research farms of Maize and Millets Research Institute (MMRI) Yousafwala, Cereal Crops Research Institute (CCRI) Nowshera, National Agricultural Research Center (NARC) Islamabad, Four Brothers Group (4B) Lahore, Petal Seed Company (PSC) Peshawar, Agricultural Research Station (ARS) Quetta, Agricultural Research Station (ARS) Gilgit, University of Agriculture Faisalabad (UAF).
- Alpha lattice incomplete block design was used for field layout of trials.
- Standard agronomic practices were followed throughout the cropping seasons.
- Data were collected for grain yield (t/h) by adjusting the moisture to 12.5%.
- Data were subjected to mean comparison, variance components and multivariate GGE biplot analysis (Yan et al.,2000).

Results:

- Grain yield for studied OPVs showed the genotypes were having variable performance and genotypic ranks across the locations. Five high yielding OPVs across every location are highlighted (Table-1).
- Heritability of the grain yield was ranging from 0.36 (ARS-Gilgit) to 0.90 (NARC;Table-1).
- Rug plot showed the data distribution of grain yield across the locations where, indicating the grain yield ranged from 2.0 t/ha (NARC) to more than 12 t/ha (PSC) across different locations (Figure-1).
- Crossover interaction dictated the used of multivariate analysis for location comparison & OPVs selection.
- GGE biplot showed that 4B, NARC and PSC were most discriminating and representative locations for OPV evaluation (Figure-2). MMRI, CCRI and UAF were moderately discriminating and representative locations while Quetta and Gilgit-Baltistan were least discriminating locations (Figure-2).
- GGE biplot showed that genotypes CZP132002, TP1219, CZP132006 and CZP132001 were among the stable and high yielding OPVs (Figure-3) compared to local checks.

Table-1: Mean grain yield and genotypic ranks for OPVs across different locations in Pakistan

OPVs		MMRI		CCRI		NARC		4B		PSC		ARS-Quetta		ARS-Gilgit		UAF	
Entry	Name	GY	Rank	GY	Rank	GY	Rank	GY	Rank	GY	Rank	GY	Rank	GY	Rank	GY	Rank
1	TP1223	6.48	17	5.53	24	2.11	30	6.44	27	7.26	28	4.21	24	7.20	21	4.18	29
2	TP1221	6.80	13	4.34	29	4.35	27	7.80	14	10.64	10	3.73	28	8.66	2	4.93	23
3	TP1222	6.27	19	5.88	19	5.86	22	6.47	26	8.68	21	3.72	29	9.30	1	5.52	21
4	TP1220	7.01	10	6.11	14	7.25	10	7.41	17	10.42	12	5.11	12	8.51	4	6.48	8
5	TP1219	6.48	17	6.54	8	7.29	9	8.62	6	12.25	3	3.86	27	7.27	20	7.16	3
6	TP1217	8.47	4	5.79	22	9.10	1	8.20	11	8.90	20	4.89	17	8.48	5	5.62	19
7	VP0720	6.80	13	4.66	28	4.13	28	6.67	23	8.41	24	4.30	23	7.16	22	5.69	17
8	CZP132001	6.59	16	6.38	11	7.92	3	8.38	8	10.77	7	4.66	21	6.36	29	7.20	2
9	CZP132002	7.07	9	6.85	7	7.47	6	9.30	2	12.09	4	4.02	25	7.79	10	6.96	4
10	CZP132003	6.07	23	5.91	17	5.96	19	7.08	19	10.42	12	4.75	20	7.44	16	5.88	12
11	CZP132004	5.86	25	5.90	18	5.95	20	6.98	20	7.20	29	5.10	13	7.66	12	5.87	13
12	CZP132005	6.27	21	6.12	13	7.34	7	7.66	15	8.45	23	2.99	30	6.61	27	6.22	9
13	CZP132006	7.01	10	6.99	4	7.87	4	8.52	7	11.63	5	5.12	11	7.44	15	5.81	16
14	CZP132007	4.92	29	5.31	26	5.69	23	5.56	30	9.37	17	4.83	18	7.04	25	5.60	20
15	CZP132008	6.27	19	6.86	6	6.93	11	7.86	13	8.61	22	4.49	22	7.39	19	6.60	7
16	CZP132009	4.81	30	5.83	21	6.10	18	6.24	29	7.48	27	4.94	16	6.21	30	5.86	15
17	CZP132010	6.06	24	6.20	12	5.90	21	6.59	24	7.03	30	5.25	7	7.88	9	6.01	10
18	CZP132011	5.86	25	7.04	3	6.69	13	7.40	18	9.42	15	4.97	15	7.48	14	5.63	18
19	CZP132012	5.65	27	6.44	9	6.25	16	6.53	25	8.23	26	5.48	2	8.13	8	5.86	14
20	13SADVE1	6.90	12	5.51	25	6.14	17	8.69	5	10.55	11	4.83	19	6.42	28	5.89	11
21	07SADVE2	7.53	6	4.91	27	3.80	29	8.08	12	10.66	9	3.97	26	7.09	24	4.75	27
22	ZM309	7.42	7	7.22	1	7.29	8	8.29	10	9.26	18	5.94	1	7.42	17	7.63	1
23	ZM401	5.23	28	7.16	2	6.72	12	7.59	16	8.33	25	5.20	8	7.72	11	4.83	25
24	ZM521	7.95	5	3.72	30	4.98	26	6.34	28	10.31	14	5.37	3	8.62	3	4.78	26
25	SC403	6.17	22	5.79	23	6.41	14	6.87	21	11.24	6	5.27	5	7.66	13	4.60	28
26	SC513	9.20	2	5.86	20	7.70	5	8.76	4	10.75	8	5.32	4	8.19	7	3.89	30
27	SC301	6.69	15	6.07	15	5.52	24	8.33	9	12.46	2	5.03	14	8.22	6	6.75	5
28	PAN413	8.57	3	6.86	5	8.94	2	8.91	3	12.69	1	5.26	6	7.42	18	4.97	22
29	PAN 3M01	7.17	8	6.03	16	6.28	15	6.79	22	9.10	19	5.19	9	7.00	26	4.85	24
30	Local Check	9.20	1	6.429	10	5.20	25	9.45	1	9.38	16	5.15	10.0	7.15	23	6.66	6
Mean		6.76	-	6.01	-	6.30	-	7.59	-	9.73	-	4.76	-	7.56	-	5.76	-
LSD (0.05)		1.65	-	1.57	-	1.41	-	1.41	-	2.87	-	0.90	-	1.72	-	2.00	-
MSe		0.98 ***	-	0.86**	-	0.68 ***	-	0.69 ***	-	2.96 **	-	0.28 ***	-	1.02 ns	-	1.37 *	-
CV		14.65	-	15.42	-	13.12	-	10.96	-	17.67	-	11.15	-	13.35	-	20.34	-
Phenotypic Variance		1.23	-	0.69	-	2.23	-	1.03	-	2.63	-	0.42	-	0.53	-	0.86	-
		0.33	-	0.29	-	0.23	-	0.23	-	0.99	-	0.09	-	0.34	-	0.46	-
Genotypic Variance		0.90	-	0.40	-	2.01	-	0.80	-	1.64	-	0.33	-	0.19	-	0.40	-
Heritability		0.73	-	0.59	-	0.90	-	0.78	-	0.63	-	0.78	-	0.36	-	0.47	-

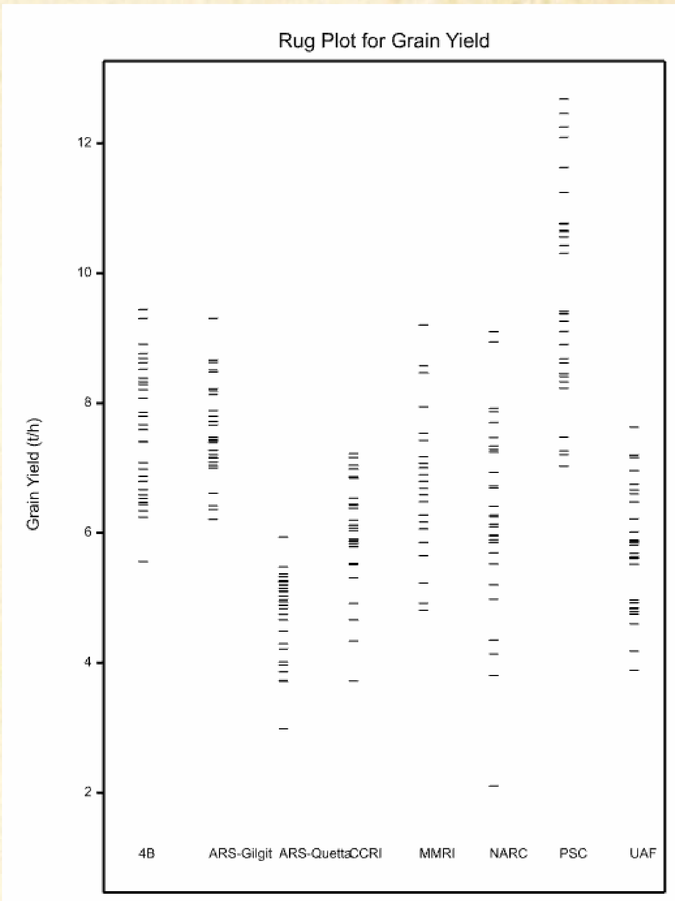

Figure-1: Rug plot for grain yield of OPVs across different locations

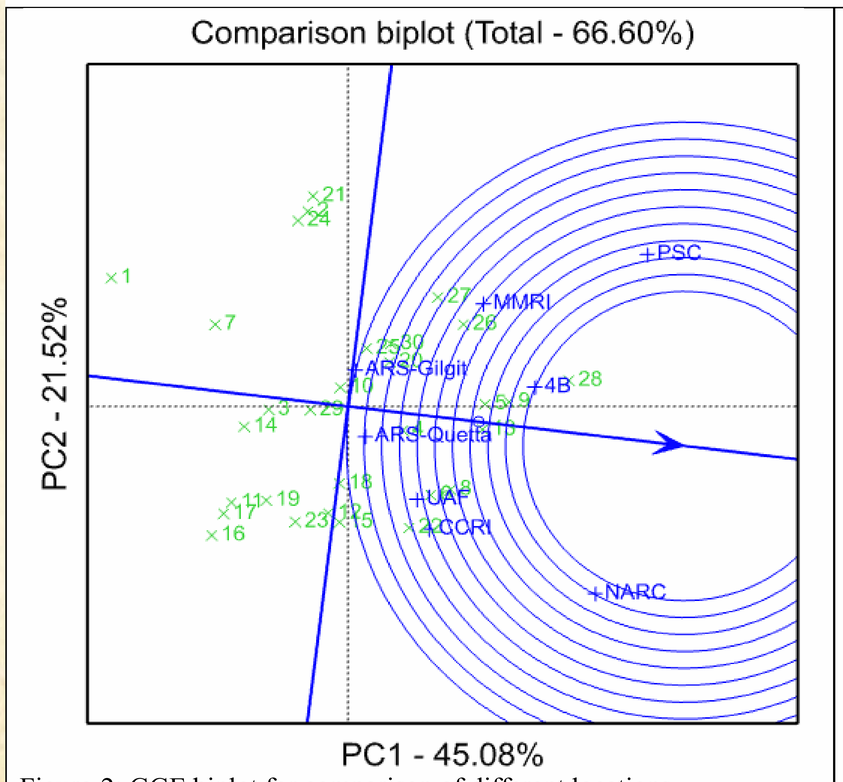

Figure-2: GGE biplot for comparison of different locations

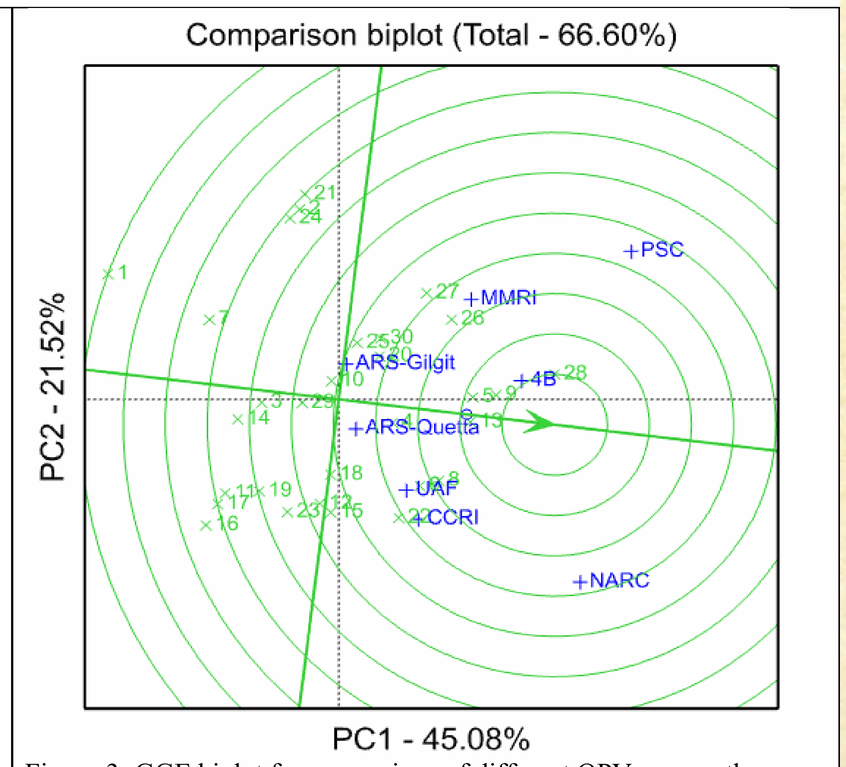

Figure-3: GGE biplot for comparison of different OPVs across the locations

Conclusions and Recommendations:

- The current study justifies the importance of OPVs in increasing productivity in South Asia where farmers have limitations to adopt high input agriculture.
- CIMMYT under the Agricultural Innovation Program for Pakistan (AIP) has allocated 13 best performing OPVs to five public and one private company for commercialization in Pakistan.

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Disclaimer:

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