



## Agricultural Innovation Program (AIP) for Pakistan

# Biofortified maize promotion to mitigate MALNUTRITION IN PAKISTAN

An initiative of the USAID-funded Agricultural Innovation Program (AIP) for Pakistan to enhance nutritional security and improve livelihoods

The Green Revolution succeeded in doubling the production and productivity of wheat – Pakistan’s staple cereal – leading to self-sufficiency. However, staple crops like wheat, maize or rice do not

provide the full nutrition that the human body requires for balanced growth and development. Non-staple but highly nutritious foods that are rich in proteins, minerals and vitamins are not affordable or accessible for resource-poor communities in Pakistan. As a result, nearly half of children in Pakistan were estimated to be chronically malnourished.

According to the World Health Organization (WHO), Pakistan also has severe sub-clinical vitamin A deficiency (VAD). The mortality rate in Pakistan due to VAD is among the highest in South Asia. Another

nutrition-related problem in Pakistan is Zinc deficiency. Both deficiencies have detrimental effects on health and development of the population

Although it is possible to tackle these challenges through diet diversification, industrial fortification and supplementation, these may not be sustainable solutions for the low-income population. Biofortification of important staple crops is a promising alternative for reaching millions of farmers and consumers. In Pakistan there are ongoing efforts to increase the nutritional quality, particularly of wheat, by increasing its kernel Zinc (Zn) content.



## Could maize be an option to contribute alleviates Pakistan’s hidden hunger?

Maize is Pakistan’s third most important cereal in terms of area sown and first in terms of productivity. The national average yield, currently around 4.2 tons ha<sup>-1</sup>, is one of the highest in South Asia. Maize productivity in Pakistan is increasing annually; maize yields have increased by almost 3 tons and total production by 300% over levels in the early 1990s. This robust growth

is attributed mainly to farmers’ widespread adoption of improved hybrid and improved agronomic practices.

Maize is a dietary staple to millions of farmers and consumers in Khyber Pakhtunkhwa (KPK), Azad Jammu and Kashmir (AJK) and Gilgit Baltistan. There are also initiatives of blending maize and wheat flour to prepare

chapatti-an unleavened flatbread –a popular staple mainly made of whole wheat flour, and other value-added maize products are in promotion in Pakistan. Maize is also gaining momentum in Sindh and Balochistan provinces – traditionally non-maize areas – where farmers have started adopting maize as a cash alternative to cotton and sugarcane due to the volatility of the latter’s markets.



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### Briefing

# Biofortified maize evaluation and validation in Pakistan

The International Maize and Wheat Improvement Center (CIMMYT) has a long history of working on biofortified maize. In the last 3-4 years, CIMMYT, in collaboration with various institutions in Pakistan, has tested biofortified maize germplasm. Under the USAID-supported AIP program, in 2014-2016 CIMMYT introduced and tested a range of biofortified improved open-pollinated varieties (OPVs) and hybrids containing high levels of Provitamin A (PVA) and kernel Zn. The grain yield performance of the top 10 PVA hybrids (see table below) shows the potential of PVA maize in Pakistan as compared to commercial checks or the national average yield.



NARC 2014 (n=24)	Grain yield (t ha <sup>-1</sup> )	CCRI 2015 (n=24)	Grain yield (t ha <sup>-1</sup> )	ICI-Pakistan 2016 (n=36)	Grain yield (t ha <sup>-1</sup> )	MMRI 2016 (n=36)	Grain yield (t ha <sup>-1</sup> )
HP1060-8	9.55	HP1100-21	9.7	HP1097-2	9.9	Local Check 1	15.4
HP1060-6	9.44	HP1097-10	9.0	HP1100-46	9.3	HP1097-2	13.3
HP1060-1	9.30	HP1100-27	8.8	Local Check 2	8.9	HP1100-22	13.2
HP1060-22	9.21	HP1100-11	8.7	HP1100-31	8.8	HP1100-28	12.9
HP1060-9	8.88	HP1100-46	8.6	HP1100-27	8.8	HP1100-25	12.8
HP1060-15	8.81	HP1097-1	8.4	HP1100-28	8.7	HP1097-10	12.6
HP1060-5	8.57	HP1097-2	8.4	HP1100-24	8.6	HP1100-37	12.5
HP1060-14	8.56	HP1097-4	8.4	HP1097-1	8.5	HP1097-16	12.4
HP1060-4	8.28	HP1100-8	8.3	HP1097-7	8.4	HP1100-46	12.2
HP1060-11	8.11	HP1097-8	8.3	HP1100-21	8.3	HP1097-8	12.1
Mean	7.76	Mean	7.34	Mean	7.88	Mean	11.67
LSD (0.05)	1.96	LSD (0.05)	2.49	LSD (0.05)	1.81	LSD (0.05)	1.95
CV	12.00	CV	16.70	CV	9.17	CV	6.40
p	**	p	*	p	*	p	***

Table: Performance of the top 10 biofortified maize hybrids as compared to local checks in Pakistan.

Based on yield and other agronomic performances, CIMMYT allocated three PVA enriched biofortified maize hybrids to partners for registration, commercial release, and further seed scale-up and delivery in target ecologies. Furthermore, a number of public and private partners shared their interest for the commercialization of PVA, and Zn enriched maize products. Earlier this year, Pakistan also released two yellow grain quality protein maize hybrids for the first time indicating the potential of biofortified maize products in the country.

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