

Introduction of Pro-vitamin A Bio-fortified Maize Hybrids in Pakistan



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Provitamin A is fat soluble carotenogenic vitamin that is essentially important for eye sight, gene transcription, immune function, embryonic development, reproductive functioning, bone metabolism, hematopoiesis, skin and cellular health. Vitamin A deficiency (VAD) is globally prevailing with more severity in developing countries. Almost every 3rd child under the age of five is suffering from VAD. Approximately 0.25–0.5 million children are getting blindness each year, particularly in Southeast Asia and Africa. Almost 190 million children of pre-school age and 19 million

pregnant or lactating women are suffering from VAD across the world in developing countries. According to the World Health Organization (WHO), Pakistan has severe sub-clinical vitamin A deficiency (VAD). Mortality rate in Pakistan due to VAD is higher than India, Bangladesh and Nepal. Number of vitamin A deficit children is increasing since 2001 and more than 50% children are suffering from VAD in Pakistan. In 2001, only 5% females were suffering from VAD whereas, currently 42% females are suffering from VAD. Nutritional diversification, industrial fortification, pharmaceutical supplementation and bio-fortification are the possible solutions to overcome VAD. Diversification, fortification and supplementation are of high cost; need more technical skills and effective only as short term solution. Bio-fortification is most convenient, accessible, affordable and preferable due to better performance based on disability adjusted life years (DALYs).

Maize research group, Department of Plant Breeding and Genetics, UAF is one of the leading partners of the International Maize and Wheat Improvement Center (CIMMYT) for the validation and deployment of Provitamin A maize hybrids in order to mitigate the problem of vitamin A deficiency in Pakistan. The collaboration, which is part of the USAID funded Agricultural Innovation Program (AIP) for Pakistan, involves testing of promising Provitamin A hybrids across different ecologies and maize growing seasons of Pakistan including but not limited to areas in Faisalabad, Sahiwal, Arifwala, Lahore, Pirsabak and

Islamabad. Among the evaluated hybrids at UAF for the last two seasons, HP1097-18, HP1097-11 and HP1097-2 were having highest grain yield potential and pro-vitamin A contents compared to well-known commercial hybrid checks. Grain yield potential for HP1097-18, HP1097-11 and HP1097-2 were 148, 143 and 140 maunds per acre, respectively.

Pedigree of hybrids

HP1097-11 : [CML197/N3//CML206]-X-32-1-4-B*5/[BETASYN]BC1-4-4-4-1-B-B-B-B-B-B-B-B-B/CML297-B//((KUIcarotenoidsyn-FS17-3-1-B-B-B-B//((KUIcarotenoidsyn-FS17-3-1-B-B-B/(CML297-BxKUICarotenoidsyn-FS17-3-2-B/KUI3xSC55)))-plant19(HH)-4-2-B-B-B-B-B

HP1097-18: CML297-B/CML300-B//((CML488/[BETASYN]BC1-13-1-1-1//G9BC1TSR-12P-1P-2P-3P-1-4-1-1-B-B-B-B-Bx CML488/[BETASYN]BC1-13-1-1//A.T.Z.T.V.C.82-1-3-1-1-1-B-B-B-B//A.T.Z.T.V.C.82-1-3-1-1-1-B-B-B-BGPO.Bx CML488/[BETASYN]BC1-13-1-1)-B-2-3-B-B-B-B-B

HP1097-2: CML297-B/CML300-B//((CML486/(CML297-BxKUICarotenoidsyn-FS17-3-2-B/KUI3xB77))-B-11-1-B-B-B-B-B-B

Future Strategy

To acquire the parental lines of these hybrids UAF has officially requested CIMMYT for allocation of these maize products. The allocation will enable UAF for further registration, commercial release, seed scale-up and delivery in the target ecologies of Pakistan. The hybrid seed will be locally produced on the seed farms of UAF and will be distributed to farmers of target ecologies for general cultivation. General public awareness campaign regarding Provitamin A benefits by mixing of pro-vitamin A bio-fortified maize flour with wheat flour will also be initiated. This will reduce the pressure on wheat consumption and will greatly help the malnourished community of Pakistan to alleviate the problem of vitamin A deficiency. In addition, the poultry and wet milling industry will be engaged to deliver value added products from these hybrids that will help farmers to get premium prices.

<div style="text-align: center; border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">HP1097-2</div> 	<p>Characterization</p> <p>Days to 50% anthesis = 48 Days to 50% silking = 50 Plant height = 216 cm Ear height = 118 cm</p> <p>Yield</p> <p>Monds / Acre = 140 Tons / Hectare = 13.60 Total carotenoid contents = 36.45 µg/g</p>
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HP1097-11**Characterization**

Days to 50% anthesis = 47
 Days to 50% silking = 49
 Plant height = 204 cm
 Ear height = 101 cm

Yield

Monds / Acre = 143
 Tons / Hectare = 13.90
 Total carotenoid contents = 37.50 µg/g

HP1097-18**Characterization**

Days to 50% anthesis = 47
 Days to 50% silking = 50
 Plant height = 228 cm
 Ear height = 129 cm

Yield

Monds / Acre = 148
 Tons / Hectare = 14.40
 Total carotenoid contents = 38.80 µg/g

