Performance of elite drought tolerant maize varieties tested on-farm in eastern and southern Africa

P.S. Setimela, G.T. Kassie, O. Erenstein J. MacRobert, C. Magorokosho, A. Tarekegne, D. Makumbi and O.Ndoro
Global Maize Program, CIMMYT, P.O. Box MP 163, Harare, Zimbabwe

Introduction

- Maize (Zea mays L.) is a major food crop in sub-Saharan Africa (FAO, 2011a) and is currently grown in nearly 100 million hectares across 125 developing countries
- Maize varieties with increased drought tolerance to abiotic stresses including heat and drought stress plays an important role in stabilizing yield and mitigating against climate change (Easterling et al. 2007; Hellin et al. 2012).
- Identification of stable and high yielding varieties is a challenge to breeders due to the presence of genotype (G) by environment (E) interaction which cannot be interpreted based only on G and E means.

Objective

- The selected hybrids and OPVs were compared with the best commercial checks in 94 sites across, two seasons under small farmers' conditions using genotype (G) plus genotype x environment (GE) interaction (GGE) biplot based on the site regression (SREG) model.


New drought tolerant hybrid on the far left compared to commercial hybrids under farmers fields.

Materials and methods

- Elite maize hybrid and open-pollinated varieties (OPVs) were selected under optimal (well fertilized and well-watered conditions), rain fed, low soil nitrogen and managed drought stress environments.
- The selected hybrids and OPVs were further tested in CIMMYT regional trials in eastern and southern Africa in more than 90 locations
- The trials were subsequently divided into two categories based on yield levels; high yielding trials >=3 t ha^{-1} (n = 47 sites) and low yielding trials < 3 t ha^{-1} (n =47 sites).
- Gender disaggregated trait preference data were generated on a sub-sample of the trials and varieties were compared based on composite preference index.

Result

- The average grain yields across eastern and southern Africa ranged from 5.5 t ha^{-1} to 3.6 t ha^{-1} in high yielding trials and 2.1 t ha^{-1} to 1.4 t ha^{-1} for low yielding trials.
- Across the two seasons CZH0616, CZH0837 and Pan 53 had highest grain yield and stability across two seasons.
- Before harvest, women focused on big cob size, good standing, early maturity, and good lodging resistance. After harvest, they emphasized big cob size, good tip cover, shiny kernels, good grain quality, and high yield.
- Before harvest, male farmers focused on big cob size, early maturity and good germination. After harvest, they emphasized big cob size and good grain
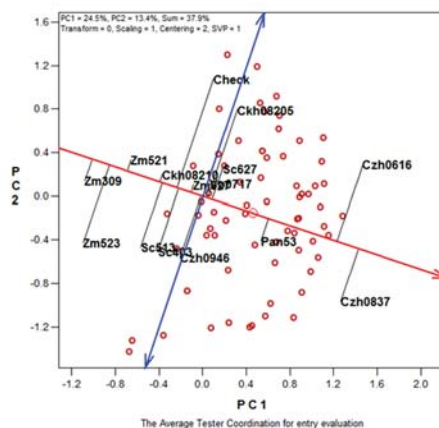
GGE Biplot based on the yield data for 14 maize hybrids in 94 locations and 2 years showing relationship among gentoytpes and best hybrids for both mean grain yield and yield
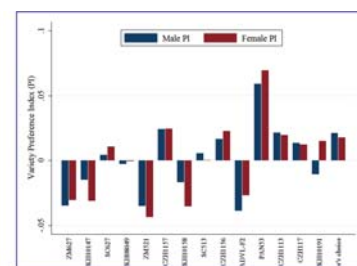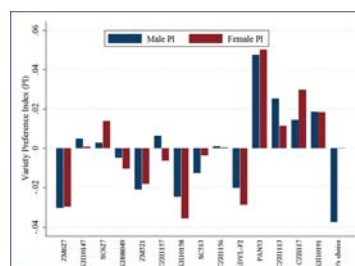
Maize Variety Preference Index before and after Harvest

Summary

- Under managed drought stress there has been wider genetic progress compared to optimal conditions.
- Hybrids developed in ESA performed equally in both regions.
- Hybrids from CIMMYT's stress breeding program showed a consistent advantage over private company hybrid checks at all yield levels.