# COMBINING ABILITY AND YIELD STABILITY OF ELITE MAIZE HYBRIDS EVALUATED UNDER CONTRASTING DISEASE AND MOISTURE ENVIRONMENTS

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A56/69590/2013

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE IN PLANT BREEDING AND BIOTECHNOLOGY

DEPARTMENT OF PLANT SCIENCE AND CROP PROTECTION

FACULTY OF AGRICULTURE

COLLEGE OF AGRICULTURE AND VETERINARY SCIENCES

UNIVERSITY OF NAIROBI

2016

**DECLARATION**

This thesis is my original work and it has not been submitted for award of a degree in any other academic institution.

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## ABSTRACT

Realization of increased maize yields from improved varieties in East Africa has commonly been hampered by biotic and abiotic stresses. Grey leaf spot, *Turcicum* leaf blight, Maize streak disease, Maize lethal necrosis (MLN) disease and moisture stress cause significant yield reduction. Double haploid (DH) technology reduces the breeding period from 7-8 generations of selfing to 3 generations. Recently, using this technology, CIMMYT developed several promising inbred lines from several bi- parental maize populations. This study was designed to study the combining ability of DH lines for yield, yield related traits and disease resistance and to assess the hybrids for grain stability across diverse environments in Kenya. Ten elite DH lines were crossed to five common single-cross testers using the line by tester mating design to form fifty three-way hybrids. The hybrids along with five most popular commercial checks were evaluated in the long rain season of 2014 across nine locations in Kenya in various agro- ecological zones. The hybrids were also screened under high viral MLN artificial inoculation in a special MLN screening site in Naivasha. A lattice design, with a spacing of 0.75x0.25m, with 42 plants per plot was used and all recommended agronomic practices followed. Data on various agronomic traits were collected and analyzed using SAS 9.3 and the GGE Biplot software. Combined analysis across location showed that most of the hybrids proved to be resistant to GLS, MSV and TLB. Ten hybrids were moderately resistant to MLN upon visual evaluation with an average score of 2.1- 3.1 (with 1-5 scale, 1 being highly tolerant and 5 highly susceptible). Line CKDHL120668 was a high yielder and disease resistant, with significant GCA scores estimate of 0.59 ($P< 0.01$) for grain yield and – 0.53 ($P< 0.01$) for resistance to GLS under optimum moisture conditions. The best combiners were hybrid CKHMLN0078 under optimum conditions and CKHMLN0097 under moisture stress, with a specific combining ability (SCA) estimate of

0.552 (P< 0.01) and 0.782 (P< 0.05) for the yield trait respectively. Grain yields across all environments showed significant variation (P< 0.001). CKHMLN0066 was the most stable hybrid as measured by the Average Environment Coordination (AEC) and the Additive Main Effect and Multiplicative Interaction (AMMI) biplot. The which- won- where GGE biplot grouped the two drought sites Homa Bay and Kiboko into one sector with CKHMLN0097 being one of the highest yielders among the top ten. Remarkably, this hybrid was a good combiner for yield under moisture stress conditions. The line CKDHL120668 could be exploited for its contribution to high yield and disease resistance while the hybrid CKHMLN0097 and CKHMLN0066 are potential candidates for varietal release under drought and well- watered conditions respectively.