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Variation of fertility among haploids of (sub)tropical maize (*Zea mays* L.)

Master-Thesis

by

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ABSTRACT

Rapid development of completely homozygous maize inbred lines can be achieved by application of the doubled haploid (DH) technique which comprises induction of a haploid phase and subsequent chromosome doubling. Currently, highly toxic chemicals such as colchicine are used as mitotic inhibitors for artificial chromosome doubling. To avoid or significantly reduce the use of colchicine, germplasm that displays high rates of spontaneous chromosome doubling or haploid plants that show partial fertility would be highly valuable to enable breeders to produce maize inbred lines using the DH technique. Therefore, the objectives of this research were to (i) study male and female fertility as well as agronomic characteristics of haploid maize plants derived from different (sub)tropical source germplasm to assess the necessity of artificial chromosome doubling for DH line development, (ii) investigate the effects of controlled vs. field conditions on haploid plant performance, and (iii) identify (sub)tropical maize germplasm that displays a high spontaneous chromosome doubling rate after in vivo haploid induction or sufficient fertility of haploid plants. Haploid plants from a total of 90 genetically diverse (sub)tropical germplasm (landraces, open-pollinated varieties, and elite single crosses) were grown under greenhouse and field conditions at two locations in Mexico. Six agronomic and five fertility-related traits were assessed on an individual plant basis. Ploidy levels were determined using visual scoring, chromosome counting, and flow cytometric analysis. Self-pollination was attempted in all plants and selfed seeds were subsequently grown to confirm their homozygous nature by visual scoring for plant and ear uniformity. Significant genotypic variation was observed for most traits. Landrace-derived haploids performed significantly poorer in fertility-related traits but there were no significant differences between the three germplasm groups for the trait kernels per ear. The environmental conditions had a grave impact on haploid male fertility and seed production as the frequency of accomplished pollinations was more than 50 % in the greenhouse compared to only 16 % under field conditions. In general, male fertility was the limiting factor of haploid performance, but several germplasm exhibited high rates of self-pollinations and some, such as e.g. DH08A-151, also excelled in seed production as ears from seven out of 10 pollinated plants were harvested in the greenhouse experiment. The identified germplasm may serve as donor for transfer of the traits to other locally adapted breeding materials which may accelerate the adoption of the DH technology for small national maize breeding programs in developing countries.