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YIELD PERFORMANCE AND GENOTYPE × PLOIDY INTERACTIONS IN DIPLOID AND TETRAPLOID MAIZE LINES

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Maize (*Zea mays* L.) remains one of the most important cereal crops worldwide, serving as a key component in food, feed, and industrial systems. Among its many agronomic traits, yield is the main criterion determining the success of a genotype under diverse environmental and genetic contexts. In this study, a polyfactorial experimental approach was employed to evaluate the yield performance of diploid and tetraploid maize lines, with the objective of understanding the extent to which genotype, ploidy level, and environmental conditions contribute to variation in productivity.

The analysis revealed that genotypic differences were the most significant contributors to yield variability, underscoring the critical role of genetic background in determining grain production. The incorporation of tetraploid lines allowed for the assessment of ploidy effects, which proved to be significant for yield, indicating that polyploidization can alter biomass partitioning and grain development pathways in maize. However, the response to ploidy level was not uniform across all genetic backgrounds, as evidenced by the significant Genotype × Ploidy interaction, which suggests that the impact of chromosome doubling on yield is highly genotype-dependent.

Environmental influence, modeled through year-to-year variation, had a moderate but noticeable effect on yield performance. The significance of Genotype × Year and Year × Ploidy interactions reflects the importance of genotype stability and the differential sensitivity of diploid and tetraploid lines to climatic and edaphic fluctuations. These findings are particularly relevant in the context of climate variability, where genotype selection must consider not only productivity potential but also environmental resilience.

Furthermore, the analysis of residual variance – ranging from 28 % to 40 % of total variation - points to the presence of uncontrolled environmental or experimental

factors, suggesting a need for more refined trial management and experimental precision. Nonetheless, these results demonstrate that the integration of polyploid genotypes into breeding programs presents valuable opportunities to expand the genetic base, explore novel allelic interactions, and enhance yield potential.

In conclusion, this study emphasizes the strategic relevance of ploidy manipulation in maize improvement efforts. By systematically evaluating how ploidy interacts with genetic and environmental variables, breeders can develop more targeted approaches to achieve yield stability and adaptability. Such approaches are essential to meet the growing global demand for maize under conditions of increasing environmental stress and limited agricultural inputs.

Keywords: maize, diploid, tetraploid, yield, variance

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