



2nd Global Conference on Agriculture

Berlin, Germany

09-11 Dec 2022

Single-plant selection at nil-competition as a means to develop promising open-pollinated lines

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Abstract

High selection pressure at the nil-competition regime has been recommended to develop maize (*Zea mays* L.) open-pollinated lines of high plant yield efficiency, approaching the crop yield performance of hybrids. Additionally, nil-competition could promote self-pollination due to the better synchronization of pollen and silk emergence to exploit the additive genetic effects. To address these hypotheses, mass selection was applied for five generations using as starting material the F₂ of the maize hybrid 'PR31G98' under open-pollination conditions and a density of 0.74 plants/m². The selection was based on single-plant yield under the selection pressure of about 7%, finally leading to two open-pollinated lines, i.e., HS₅-21 and HS₅-23. To assess the lines' crop yield potential, they were evaluated along with ten commercial hybrids across two locations and two years at the density of 8.89 plants/m² with adequate irrigation and fertilization (normal regime), and the density of 5.33 plants/m² with deficit irrigation and fertilization (low-input regime). The hybrids averaged 164 and 119 kg/ha at the normal and low-input regimes, respectively. In relation to hybrids, line HS₅-21 yielded 97% (159 kg/ha) at the normal regime and 79% (93 kg/ha) at the low-input regime. The respective records of line HS₅-23 were 106% (174 kg/ha) and 86% (102 kg/ha). The results were promising regarding enhanced gene fixation and exploitation of additive gene action. The high selection pressures led to relatively homogeneous half-sib lines that approximate the productivity and stability levels of commercial hybrids.

Keywords: additive gene action, line-to-hybrid gap, plant yield efficiency, selection pressure