Efficient Methods to Develop New Sweet Corn Cultivars for Organic Systems

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Abstract

Organic farming systems differ from their conventional counterparts in ways that may affect the relative performance of plant genotypes. If cases where rank-change genotype by system interactions are present, selection in organic environments may be most appropriate when developing cultivars for organic systems. However, doing so requires efficient approaches. Synthetic varieties produced from intermating multiple inbred lines may be an appropriate method for developing stable and adaptable cultivars of cross-pollinated crops such as sweet corn (*Zea mays*). Mating designs such as North Carolina Design II (NC DII), as well as marker-based Best Linear Unbiased Prediction (BLUP), can allow the prediction of the performance of a large number of hybrids and synthetics based on the evaluation of a smaller subset of tested hybrids and inbreds. These techniques can increase the efficiency of hybrid trials and allow testing to be done in more environments, which in turn can help to identify potentially stable material for organic systems.

The goal of this research is to develop efficient methods to develop new sweet corn cultivars for organic systems. The objectives of this research are three-fold:

1. Determine the utility of using structured mating designs and genotypic information to select untested sweet corn hybrids and synthetic varieties for organic environments.
2. Determine whether synthetic varieties are more stable than hybrids in a range of organic environments.
3. Determine whether certain traits are more stable than others across locations.

These objectives will be accomplished by conducting trials of sweet corn hybrids developed through a series of crosses following the NC DII mating structure, along with the parental inbreds. These trials will be carried out in 12 organic environments total over two years. The results of these trials will be extended to predict untested crosses using both traditional methods of general combining ability evaluation from the NC DII as well as incorporating marker data and using marker-based BLUPs. The results of tested and untested crosses will be used to predict high performing hybrids and synthetic varieties. A subset of the hybrids and synthetics predicted to be high performing, as well as a random set of hybrids and synthetics will be tested across six organic environments to determine the predictive power of this testing system for identifying high performing and stable material. The results of these trials will be used to measure the relative stability of key phenotypic traits in order to determine which traits can be more readily evaluated in a few locations and which traits require extensive testing across environments. Preliminary results from the first year of trials were presented during the Organic Agriculture Research Symposium.

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