Redesigning Potato Breeding to a F1 Hybrid Variety at Michigan State University

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The Challenge

Currently, improving traits for a commercial variety through conventional breeding is a slow and challenging process. Genetic gains cannot be easily fixed in cultivated tetraploid potato due to inherent heterozygosity. Furthermore, cultivated tetraploid potato varieties make conventional breeding challenging due to the unpredictable nature of inheritance of desirable traits.

Objective

Our overall goal is using the dominant self-incompatibility inhibitor *Sli* gene from M6 (*S. chacoense*) to modify self-incompatible (SI) diploid species hybrids and cultivated dihaploids to self-compatible (SC) population pools that will be used to create diploid inbred lines for F1 potato hybrid varieties.

Diploid Breeding Advantages

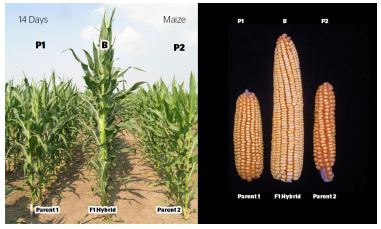
- Use wild species with diverse traits
- Simplified genetics
- More predictable breeding

Diploid Breeding Priorities

- We developed three germplasm pools through different breeding methods
- Cultivated/Commercially important tuber traits
- Disease resistance to scab, late blight, and viruses
- Yield: tuber size, set, and shape

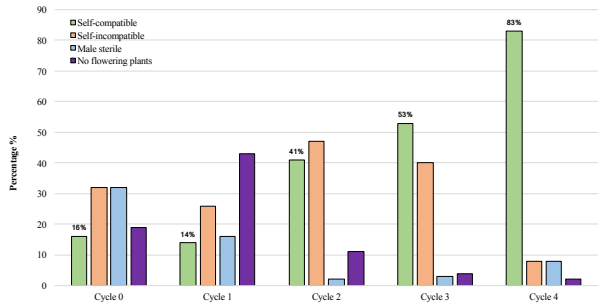
Advantages of F1 Hybrid Diploid Potato Varieties - Maize F1 Hybrid Model

- Capture heterosis
- Fix a deficiency in a variety
- Predictably improve a variety
- Use modern breeding methods and genomic resources
- Respond quickly to industry needs



Iowa State University

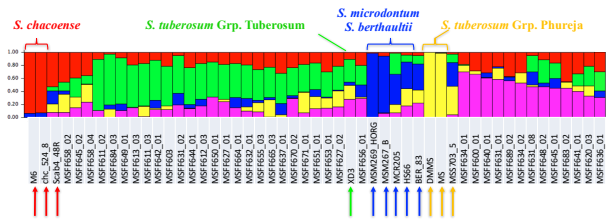
Recurrent Selection Breeding Method to Improve Self-compatibility



Recurrent Selection MSDD829-9 (2x)

Maher Alsahlany with MSEE815-7 (2x)

Population Structure Analysis of Parents and Recurrent Selection Cycle 4



Backcross Breeding to Introgress Self-compatibility to *S. tuberosum* Dihaploids

- Backcross breeding to introgress self-compatibility from RS selections and M6 (*S. chc*)
- *S. tuberosum* dihaploids from advanced clones and varieties with agronomically important traits
  - Marketable maturity, yield, tuber shape, SG
  - Chip-processing and freshmarket
  - Disease resistances (late blight, scab, PVY)

MSEE706-03S1-02 (2x)

MSEE815-06 (2x)

Summary

- Developed diploid germplasm foundation for the MSU diploid breeding effort
- Advanced inbred line development
- Focus on chip-processing and freshmarket varieties
  - Round-white, yellow-flesh, red skin, and specialty

Acknowledgements

This research is supported by USDA/AFRI, USDA/NIFA potato breeding funds, and the Higher Committee for Education Development in Iraq.

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