POTATO FUTURES: IMPACT OF HYBRID VARIETIES

Jim Lorenzen
Bill & Melinda Gates Foundation
WHY AGRICULTURE?

Poverty Reduction

- Transformed economies begin with *agricultural transformation*
- *Ag intensification* leads to surpluses, value chains, food processing
- Related local economic opportunities (service/input providers, inputs, labor, aggregation, and transport chains) **create employment**, high multiplier effect
- Moving into cash economy accelerates priority of education, enables improved nutrition
Our Vision

Agricultural transformation led by countries to support smallholder farmers.

We want farmers to be empowered with the knowledge, tools and technologies to improve their livelihoods and lift themselves and their families out of poverty.

Our Objectives

• Boost the productivity of staple crops and livestock, on which millions of smallholder farmers rely to feed their families.
• Increase incomes of smallholder farmers to enable them to lift themselves out of poverty.
• Increase safe and affordable access to nutrient-rich foods for the poorest people in sub-Saharan Africa and South Asia.
• Empower women farmers to have greater access to resources and opportunities, as well as more control over decisions affecting their farms and families.
Smallholder needs and potato

- Intensification leading to food sufficiency
- Diversification for income generation from surplus production
- Potato is a major source of cash income for smallholders where adapted
- High market demand for potatoes across global South; “seed” has brought new P&D
- Poor seed quality is a major constraint
- Resistance to major pests and diseases, including viruses is high priority
- “Green bridge” and multiple seasons/year increase pest and disease intensity
Potato issues in Africa

- Degenerated seed of traditional varieties (virus complex)
- Many pests and diseases introduced
  - Viruses, viroids, including necrotic strains
  - Bacteria: Ralstonia, Pectobacterium, …
  - Fungi: LB, EB, Wart, Verticillium,
  - Nematodes: PCN, RKN, etc.
  - Insects: PTM, leaf miner, Tuta
- Abiotic stress, especially heat
- Distance and transport infrastructure to market
Promise of diploid hybrid breeding

- Long time coming: long history of ploidy manipulation, diploid utilization in breeding
- Systematic population improvement; simpler to fix key traits in separate pools
- Possible to backcross essential loci into parents of otherwise superior hybrids
- However, this will take patience, persistence, and numbers
- Genetic load is a big issue across clonal crops (years of clonal propagation interspersed with occasional meioses)
- Promise and hope are high, but technology and knowledge advances have also accelerated 4x breeding
Promise of diploid hybrid breeding - International

- For clonal crop breeding networks - “seed” cleanup, indexing, and export/import are major bottlenecks for **regional** breeding networks
- Much easier to certify and export TPS
- With genetically uniform TPS, more seeds can be distributed for bigger plots at multiple locations, resulting in more and better data
- More and better data will accelerate progress across target populations of environments to know genotype potential across region
Conclusions

- Diploid hybrid potato breeding promises easier and faster breeding, potentially radical changes in seed systems.
- Realizing the promise could be a lengthy process.
- A regular safe means of moving improved seed could greatly reduce the risk of moving pests and pathogens with current field-grown seed system.
- Adapted hybrid cultivars for Africa could potentially spread much faster than clonal seed and achieve more rapid impact.
THANK YOU!