# Table of Contents

## Idaho Potatoes Case Study

<table>
<thead>
<tr>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive Summary</td>
</tr>
<tr>
<td>1. Market Dynamics</td>
</tr>
<tr>
<td>2. Leadership</td>
</tr>
<tr>
<td>3. Research &amp; Varietal Development</td>
</tr>
<tr>
<td>4. Demand Planning &amp; Operations</td>
</tr>
<tr>
<td>5. Financial Sustainability</td>
</tr>
<tr>
<td>6. Enabling Environment</td>
</tr>
</tbody>
</table>

## Appendix
Executive Summary
Public Sector Funds Varietal Development and Private Sector Manages the Rest

- **GERMLASM/VARIETIES**
  - Breeder Seed
  - Foundation/Basic Seed
  - Certified Seed/QDS

**Who does?**
- **Public**
- **Private**

**How financially self-sustaining?**
- Low: ≤ 1/3 of OpEx
- Medium: 2/3 ≤ x > 1/3 of OpEx
- High: ≥ 2/3 of OpEx

**Varietal Development**
- **CULTIVATION**
- **STORAGE**
- **CONSUMPTION**

**CERTIFIED SEED**
- Demand forecasting and production planning

**Mature**
- Mostly Formal

**FOUNDATION SEED**
- Demand forecasting and production planning

---

**Occupancy**
- 100%
Organizational Leadership by Value-Chain Step

Pre-Release
ARS-Aberdeen & Prosser, Tri-State Universities

Breeder
Conducted Basic Seed Growers

Certified (Early)
Conducted Increase Seed Growers

Certified (Late)
Potato Industry

Commercial

Varietal Testing Trials
(Statewide, Tri-State Area and Western Regional Trials)

Variance Release
(PVMI Manages Varieties from Tri-State Program)

University of Idaho
College of Agricultural and Life Sciences
Nuclear Seed Potato Program
(Produces disease-free minitubers and plantlets)

Royalty Collection (PVMI)
Seed Inspection
(Varies by State e.g., Idaho Crop Improvement Association)

Check-Off Fund Collection
(First handler pays to US Potato Board)
# Early Generation Seed Deployment Model

<table>
<thead>
<tr>
<th>Who</th>
<th>Breeder Seed</th>
<th>Foundation (Nuclear) Seed</th>
<th>Certified Seed</th>
<th>Commercialization</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Who</strong></td>
<td><strong>USDA-ARS</strong> Aberdeen, ID</td>
<td><strong>Nuclear Seed Potato Program</strong> University of Idaho (Moscow, ID)</td>
<td><strong>Independent Seed Growers</strong></td>
<td><strong>Independent Growers</strong> Purchase seed from certified seed growers</td>
</tr>
<tr>
<td><strong>Sector</strong></td>
<td><strong>Public</strong></td>
<td><strong>Public (but financially sustainable)</strong></td>
<td><strong>Private</strong></td>
<td><strong>Private</strong></td>
</tr>
<tr>
<td><strong>Input</strong></td>
<td><strong>80 lb. of Pre-Breeder Seed</strong></td>
<td><strong>800 lb. of Breeder Seed</strong></td>
<td><strong>8,000 lb. of mini-tuber, (200,000-250,000 Plantlets per year)</strong></td>
<td><strong>80,000 lb. Certified Mini-tuber Seed</strong></td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td><strong>800 lb. Breeder mini-tuber Seed</strong></td>
<td><strong>8,000 lb. mini-tubers (Foundation Seed)</strong></td>
<td><strong>80,000 lb. Certified mini-tubers</strong></td>
<td><strong>49.5 billion pounds of Commercial Potatoes</strong></td>
</tr>
<tr>
<td><strong>Capital Sources</strong></td>
<td>• State Funding</td>
<td>• Nuclear seed sales cover all costs of nuclear seed production</td>
<td>• Certified seed sales</td>
<td>• Commercial seed sales</td>
</tr>
<tr>
<td></td>
<td>• NIFA grants</td>
<td></td>
<td>• NOTE: State potato commissions collect assessments to fund state marketing and potato research</td>
<td>• NOTE: potatoes USA collects an assessment to fund marketing activities for all U.S. potato growers</td>
</tr>
</tbody>
</table>
### Key Success Factors

#### Financial Sustainability

- **Seed System is Self-Funded; Breeding Activities Supported by Multiple Funding Sources**
  - Public Sector Funds Tri-State Research
  - Seed Multiplication Occurs on a Cost Recovery Basis Due to Grower Willingness (& Requirement) to Pay For Quality Seed
  - PVMI Empowered by Growers to Collect Royalty and Licensing Fees on Tri-State released Varieties
  - Independent 3rd Party Provides Service to the Value Chain That Ensures Prices Received Increase with Grower Costs

#### Demand Planning & Operations

- **Compulsory Certified Seed Market of Commercial Growers Who are Tightly-Linked to Seed Producers**
  - Communication Between Seed Growers and Downstream Users
  - Nuclear Seed Supply Planning Encourages Seed Producers to Pre-Order and Be Reliable Buyers
  - Seed Growers Anticipate Commercial Demand Through Deep Understanding of Customer Operations & Understanding of Market Dynamics Through Industry Connections
  - Public Sector Structures Evaluations to Account for Private Sector Input on Breeding Targets
  - Seed Growers are Highly Specialized and Grow Seed Potatoes in Isolated Areas to Reduce Contamination Risks

#### Enabling Environment

- **Concentrated Group of Growers Supported By a Publicly Funded Breeding Program**
  - Farmer & Industry Trusted, and Supported Research Program
  - Industry Involvement in Variety-Specific GAP Ensures Tri-State Varieties Realize Full Market Potential
  - Close Proximity & Collaboration Among Stakeholders
  - Industry Marketing Association Effectively Utilizes Tools and Lean Structure to Increase Farmer Demand for Tri-State Varieties
  - Seed Quality Assurance Agency is Reputable and Reliably Fulfills its Mandate to Certify 100% of Seed
  - Breeder-to-Breeder Collaborations Increase Access to Germplasm
  - Grower Demand for Quality Seed Resulted in Seed Laws Requiring 100% Certification
Financial Sustainability

### Public Sector Funds
**Tri-State Research**
Research and varietal development are funded by a variety of public sources including funds from the universities, USDA-ARS, and NIFA grants. The Aberdeen Research and Extension Center Superintendent is the only University of Idaho employee hard funded by the university; all other employees are funded through NIFA grants. USDA-ARS provides overhead funding for ARS employee salaries.

### Seed Multiplication
**Occurs on a Cost Recovery Basis Due to Grower Willingness (& Requirement) to Pay For Quality Seed**
Beyond varietal development, this system is mostly self-funded. Nuclear seed and certified seed are both produced on a cost-recovery basis due to downstream consumers willingness to pay for quality seed at each multiplication stage, but also due to the requirement that commercial growers purchase certified seed. In Idaho and many surrounding states, 100% of commercial potatoes grown must have been produced from certified seed. Growers at all phases of multiplication have the choice to look elsewhere for non Tri-State varieties, but more than 80% of certified seed growers in Idaho choose to pay for the quality of Tri-State varieties through PVMI, allowing for financial sustainability of NSPP and the certified seed growers.

### PVMI Empowered by Growers to Collect Royalty and Licensing Fees on Tri-State released Varieties
PVMI also operates on a cost recovery basis from royalties and licensing fees collected on the Tri-State varieties. PVMI has exclusive rights to license Tri-State varieties and uses this income to fund its marketing, public relations, and administrative costs. Any funds brought in by PVMI beyond the budget necessary for funding these PVMI functions are directed back toward Tri-State breeding activities. One key to PVMI’s financial success is that it is responsible for managing the dissemination of varieties in the US and internationally and can ensure that all royalties and licensing fees that should be brought back to the programs are collected, providing financial security.

### Independent 3rd Party
**Provides Service to the Value Chain That Ensures Prices Received Increase with Grower Costs**
The University of Idaho provides updated crop budgets every two years to inform crop producers, lenders, and processors of the changing costs and returns on cropping enterprises. These budgets originated as a service to growers to not only assist them in planning for changing future costs of production, but also to help provide leverage with processors when negotiating for higher compensation. As grower costs rose in the past, processors did not have visibility into these changes and were not adjusting grower payments. These crop budgets are available online for growers to access for no fee when negotiating changes in compensation.
## Demand Planning and Operations

<table>
<thead>
<tr>
<th>Key Success Factors</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication Between Seed Growers and Downstream Users</td>
<td>Potato seed growers are connected to all downstream users, including commercial growers and processors, through multiple channels and based on long-standing relationships. Connections with and knowledge of industry needs and trends provides valuable planning information to seed growers.</td>
</tr>
<tr>
<td>Nuclear Seed Supply Planning Encourages Seed Producers to Pre-Order and Be Reliable Buyers</td>
<td>The Nuclear Seed Potato Program (NSPP) operates on a yearly production planning cycle to ensure that supply meets demand. Growers typically place orders in December to receive mini-tubers or plantlets by the next fall. The program does not plan for surplus demand and this encourages growers to plan well in advance of immediate needs. Informal agreements for picking up and paying for seed exist in place of binding contracts. Self-regulation in adhering to the informal agreements is made effective on the basis of grower reputation being dependent on following through on ordering commitments.</td>
</tr>
<tr>
<td>Seed Growers Anticipate Commercial Demand Through Deep Understanding of Customer Operations &amp; Understanding of Market Dynamics Through Industry Connections</td>
<td>Seed growers lean on their experience to operate at optimal production capacities and are well trained on how to achieve certification standards through repeated interactions with Idaho Crop Improvement Association. The best seed growers operate on a four-year production planning cycle and do not plan for oversupply. It is extremely difficult to market surplus potatoes due to changes in fresh market and processing qualities once the potatoes are stored for extended periods. A seed grower coop has developed an alternative channel for the “big uglies” that cannot be sold into traditional channels, but growers do not rely on this channel’s availability when planning their supplies. Growers only supply varieties that their customers demand and are cautious to bring on new varieties that do not display sufficient requests.</td>
</tr>
<tr>
<td>Public Sector Structures Evaluations to Account for Private Sector Input on Breeding Targets</td>
<td>The public and private sectors collaborate to evaluate developmental lines for traits that increase the profitability of commercial potato production, especially related to fry processing characteristics. The public sector recognizes the value of considering early input from the private sector on field performance trials during the first three years of development to increase the efficiency of its resource allocation and improve the commercial adoption of new varieties. Private companies also recognize that providing feedback to the breeding program is pivotal to successful variety development and industry advancement and offer input willingly.</td>
</tr>
<tr>
<td>Seed Potatoes are Grown in Isolated Seed Management Areas To Reduce Contamination Risks</td>
<td>The majority of potato seed growers are seed growers exclusively and do not cross over into commercial production. They grow in specified Seed Management Areas away from commercial production farms to reduce the risk of contamination of their seed crops by pests and pathogens that can jeopardize seed certification. Any potatoes grown in Seed Management Areas is held to a higher standard due to certification rules than those grown in conventional areas and demand a higher grower price reflecting the quality advantages.</td>
</tr>
</tbody>
</table>
## Enabling Environment

<table>
<thead>
<tr>
<th><strong>KEY SUCCESS FACTORS</strong></th>
<th><strong>Description</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Farmer &amp; Industry</strong></td>
<td>Potato seed and commercial growers trust the Tri-State Program to deliver improved, virus free varieties in their new releases. Certified seed growers have the option to buy varieties from public sources (other than the NSPP), but ~80% or more are willing to pay for the Tri-State varieties through PVMI due to perceived quality advantages. Industry, mainly driven by the quick serve fry market, also demands the improved Tri-State varieties due to their superior frying characteristics.</td>
</tr>
<tr>
<td><strong>Trusted &amp; Supported</strong></td>
<td>University of Idaho and the University of Washington provide growers with agronomic information on Tri-State varieties through management bulletins and presentations, but little extension activity is available for on-farm grower support. Industry representatives, with interest in receiving quality potatoes in desirable volumes, have stepped in to act as the go-to sources when growers have specific growing questions. The ability for large potato companies to access University of Idaho TC labs and industry testing of pre-released materials encourages a strong and lasting bond between industry and the university.</td>
</tr>
<tr>
<td><strong>Research Program</strong></td>
<td>Idaho, Washington, and Oregon consistently rank as the top potato producing states in the US. The close proximity of actors, including breeders and researchers at all three land grant universities and ARS, state seed certifiers, growers, and processors encourages the development of trust-based relationships and an ability to collaborate within the Tri-State area. At times when funding is tight at any one institution, the other institutions will step in and alleviate those pressures by reallocating funds for the overall advancement of the Tri-State program.</td>
</tr>
<tr>
<td><strong>Industry Involvement</strong></td>
<td>Industry Marketing Association Effectively Utilizes Tools and Lean Structure to Increase Farmer Demand for Tri-State Varieties</td>
</tr>
<tr>
<td><strong>Variety-Specific GAP</strong></td>
<td>PVMI is a trusted resource for Tri-State potato variety marketing, public relations, collection of royalty and licensing fees, and general management of variety dissemination. PVMI is operated by two employees that report to a board of directors and operates as a fully funded non-profit. This financial sustainability is made possible through a conservative use of human resources, with the optimal capacity being able to perform all necessary functions related to marketing and administration. No extra grower money or time is spent on unnecessary personnel or functions. PVMI was initially funded by a $250,000 grant underlining the importance that growers and industry saw for this type of organization to exist.</td>
</tr>
<tr>
<td><strong>Ensures Tri-State</strong></td>
<td>Seed Quality Assurance Agency is Reputable and Reliably Fulfills its Mandate to Certify 100% of Seed</td>
</tr>
<tr>
<td><strong>Varieties Realize Full Market Potential</strong></td>
<td>The Idaho Crop Improvement Association is the organization mandated to certify 100% of Idaho seed potatoes under the 1996 Idaho Seed Potato Law, with operations overseen by Idaho State University. ICIA is built on a reputation of transparency in certification practices and experienced agents and has been the duly authorized agent to administer and conduct Idaho seed certification since 1959. The program relies on certifying agents who have 10+ years of experience with the program to operate quality inspections and certifications. The director ensures that no conflicts of interest arise from long standing relationships between inspectors and growers by rotating inspectors so that the fields on a farm are not routinely inspected by the same inspectors.</td>
</tr>
</tbody>
</table>

**Close Proximity & Collaboration Among Stakeholders**

Idaho, Washington, and Oregon consistently rank as the top potato producing states in the US. The close proximity of actors, including breeders and researchers at all three land grant universities and ARS, state seed certifiers, growers, and processors encourages the development of trust-based relationships and an ability to collaborate within the Tri-State area. At times when funding is tight at any one institution, the other institutions will step in and alleviate those pressures by reallocating funds for the overall advancement of the Tri-State program.

**Industry Marketing Association Effectively Utilizes Tools and Lean Structure to Increase Farmer Demand for Tri-State Varieties**

PVMI is a trusted resource for Tri-State potato variety marketing, public relations, collection of royalty and licensing fees, and general management of variety dissemination. PVMI is operated by two employees that report to a board of directors and operates as a fully funded non-profit. This financial sustainability is made possible through a conservative use of human resources, with the optimal capacity being able to perform all necessary functions related to marketing and administration. No extra grower money or time is spent on unnecessary personnel or functions. PVMI was initially funded by a $250,000 grant underlining the importance that growers and industry saw for this type of organization to exist.

**Seed Quality Assurance Agency is Reputable and Reliably Fulfills its Mandate to Certify 100% of Seed**

The Idaho Crop Improvement Association is the organization mandated to certify 100% of Idaho seed potatoes under the 1996 Idaho Seed Potato Law, with operations overseen by Idaho State University. ICIA is built on a reputation of transparency in certification practices and experienced agents and has been the duly authorized agent to administer and conduct Idaho seed certification since 1959. The program relies on certifying agents who have 10+ years of experience with the program to operate quality inspections and certifications. The director ensures that no conflicts of interest arise from long standing relationships between inspectors and growers by rotating inspectors so that the fields on a farm are not routinely inspected by the same inspectors.
Enabling Environment (cont.)

**Breeder-to-Breeder Collaborations Increase Access to Germplasm**

Tri-State early stage breeding clones (pre-varieties) are initially grown in greenhouses from true potato seed, with only the largest tubers generated from the seedlings kept by ARS for further planting and evaluations in the next field year. To increase germplasm availability in the potato breeding industry, breeders throughout the US (Tri-state, ND, ME, TX, WI, CO) exchange the second and third largest tubers (without the hindrance of IP agreements) in order to facilitate the maintenance of genetic diversity within a breeding program and optimize the use of additional seedling tubers generated by each cooperating breeding program. These shared seedling tubers would otherwise be thrown away.

**Grower Demand for Quality Seed Resulted in Seed Laws Requiring 100% Certification**

The Idaho Seed Potato Law was enacted by the Idaho State Legislature in 1996 largely in response to a nation-wide task force that recommended mandatory seed laws as a way to combat bacterial ring rot outbreaks. The law mandates that 100% of commercial potatoes grown in Idaho must be planted as certified seed, with traceable inspection metrics available throughout the certification process. The University of Idaho is the seed certifying authority designated by the state of Idaho and oversees Idaho Crop Improvement’s seed inspection and certification activities. This seed law is one of the first cases where certification was made mandatory at the request of growers to solve an industry threat.
EGS Seed System Pain Points

Financial Sustainability
- Heavy reliance on grant funding and federal and state funding leads to uncertainties each year on how much each program will receive for operations

Demand Planning & Operations
- Growers believe that it is difficult to scale up a seed growing operation because quality management practices are not scalable
- The more varieties or acres a grower produces, the greater risk they take of whole farm disease issues
- Human error in virus testing and errors inherent with small sample sizes at the Hawaii winter location can lead to perceptions of false certification testing results
- Correct storage methods and alternative channels for oversupply keep seed growers operating on a supply-only-to-demand basis

Enabling Environment
- NSPP lacks clear and binding formal grower contracts on seed orders presenting considerable financial risk
- ICIA’s governance structure makes for long lead times when changes need to be made in the certification process
# Idaho Potato EGS System

<table>
<thead>
<tr>
<th><strong>1900-1949</strong></th>
<th><strong>1950-1999</strong></th>
<th><strong>2000-Present</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FINANCIAL</strong></td>
<td><strong>DEMAND</strong></td>
<td><strong>2006-</strong> Tri-State Commissions contribute $225k to PVMI Initiation; PVMI business plan creation assisted through federal funding</td>
</tr>
<tr>
<td>Levies</td>
<td>Planning/Operations Technology</td>
<td>2010- First Year that university breeding programs receive royalties from PVMI</td>
</tr>
<tr>
<td>Royalties</td>
<td>Systems</td>
<td><strong>Continued financial support</strong> from PVMI through royalty collection</td>
</tr>
<tr>
<td><strong>ENABLING ENVIRONMENT</strong></td>
<td><strong>1928-</strong> ID Grower Shippers Assn. formed</td>
<td><strong>2011-</strong> Oregon State University begins using NSPP to clean up OSU breeding clones</td>
</tr>
<tr>
<td>Policies</td>
<td><strong>1940-</strong> University of Idaho Research Station at Aberdeen established (potato breeding was completed in Maryland beginning in 1930s)</td>
<td><strong>2013-</strong> ICIA moved winter testing location from CA to HI</td>
</tr>
<tr>
<td>Systems</td>
<td><strong>1926-</strong> Rogers Brothers Seed Company completes first dehydration of Idaho potatoes for food products; credited as beginning of processing industry</td>
<td><strong>2018-</strong> NSPP plans to expand greenhouse space and double production capabilities</td>
</tr>
<tr>
<td><strong>1914-</strong> University of Idaho potato breeding program established by USDA -ARS</td>
<td><strong>1984-</strong> USDA joined existing potato breeding program with the ID, WA, OR potato industries; start of the Tri-State Potato Breeding Program.</td>
<td><strong>Continued</strong> improvements in molecular techniques to improve seed quality instead of relying solely on visual inspections</td>
</tr>
<tr>
<td><strong>1937-</strong> Growers payed the ID Fruit and Vegetable Advertising Commission 1 cent/cwt for promotion of industries</td>
<td><strong>1983-</strong> Nuclear Seed Potato Program begins at University of Idaho, when a focus on clean TC was beginning to gain importance. Leadership remained the same until 2016.</td>
<td><strong>2004-</strong> Tri-State potato commissions warrant Income Potential Feasibility Studies for royalty collections on potential Tri-State varieties</td>
</tr>
<tr>
<td><strong>1939-</strong> Checkoff reduced to .05 cents/cwt (seed potatoes exempt). Initially reduced advertising budget, but increased potato production actually increased the overall budget in the long run</td>
<td><strong>1993-</strong> Idaho Pure Seed law written requiring all Idaho potato seed be certified</td>
<td><strong>2005-</strong> PVMI incorporated as non-profit, initiated by state potato commissions</td>
</tr>
<tr>
<td>1951- Idaho commercial potato farmers received $1/cwt more for potatoes than farmers in other regions due to demand created from marketing</td>
<td><strong>1995-1996-</strong> Seed law implemented requiring all Idaho potato seed be certified</td>
<td><strong>1950-1999 2000-Present</strong></td>
</tr>
<tr>
<td>1872- Original Burbank variety developed- beginning of Idaho potato industry</td>
<td><strong>1984-</strong> Nuclear Seed Potato Program begins at University of Idaho, when a focus on clean TC was beginning to gain importance. Leadership remained the same until 2016.</td>
<td><strong>2011-</strong> Oregon State University begins using NSPP to clean up OSU breeding clones</td>
</tr>
<tr>
<td>1940- Widespread sprinkler irrigation begins in Idaho potato industry, including technologies that allow for irrigation of fields on rolling hills, leading to increased production</td>
<td><strong>1993-</strong> Idaho Pure Seed law written requiring all Idaho potato seed be certified</td>
<td><strong>2013-</strong> ICIA moved winter testing location from CA to HI</td>
</tr>
<tr>
<td>1940- Idaho Crop Improvement Association est. by Idaho seed growers</td>
<td><strong>1995-1996-</strong> Seed law implemented requiring all Idaho potato seed be certified</td>
<td><strong>2018-</strong> NSPP plans to expand greenhouse space and double production capabilities</td>
</tr>
<tr>
<td>1940- Idaho Seed Growers Association joined ICIA</td>
<td><strong>1951-</strong> Idaho Pure Seed Law updated (Title 22)</td>
<td><strong>Continued</strong> improvements in molecular techniques to improve seed quality instead of relying solely on visual inspections</td>
</tr>
<tr>
<td><strong>1989-</strong> University of Idaho potato breeding program established by USDA -ARS</td>
<td><strong>1955-</strong> Patent filed for ‘GROWN in Idaho’ label</td>
<td><strong>2004-</strong> Tri-State potato commissions warrant Income Potential Feasibility Studies for royalty collections on potential Tri-State varieties</td>
</tr>
<tr>
<td><strong>1995-</strong> Patent filed for ‘GROWN in Idaho’ label</td>
<td><strong>1959-</strong> IPC worked with packers to identify ‘Packed in Idaho’ designation</td>
<td><strong>2005-</strong> PVMI incorporated as non-profit, initiated by state potato commissions</td>
</tr>
<tr>
<td><strong>1959-</strong> Seed and Plant Certification Act designated the Univ. of ID to assign an agent to conduct seed certification; ICIA was appointed</td>
<td><strong>1967-</strong> JR Simplot begins working with Ray Kroc to supply frozen French fries to McDonald’s</td>
<td><strong>1950-1999 2000-Present</strong></td>
</tr>
<tr>
<td><strong>1989-</strong> Idaho Pure Seed Law updated (Title 22)</td>
<td><strong>1983-</strong> Nuclear Seed Potato Program begins at University of Idaho, when a focus on clean TC was beginning to gain importance. Leadership remained the same until 2016.</td>
<td><strong>2011-</strong> Oregon State University begins using NSPP to clean up OSU breeding clones</td>
</tr>
<tr>
<td><strong>1993-</strong> Idaho Pure Seed law written requiring all Idaho potato seed be certified</td>
<td><strong>1984-</strong> USDA joined existing potato breeding program with the ID, WA, OR potato industries; start of the Tri-State Potato Breeding Program.</td>
<td><strong>2013-</strong> ICIA moved winter testing location from CA to HI</td>
</tr>
<tr>
<td><strong>1995-1996-</strong> Seed law implemented requiring all Idaho potato seed be certified</td>
<td><strong>1995-1996-</strong> Seed law implemented requiring all Idaho potato seed be certified</td>
<td><strong>2018-</strong> NSPP plans to expand greenhouse space and double production capabilities</td>
</tr>
<tr>
<td><strong>1951-</strong> Idaho Pure Seed Law updated (Title 22)</td>
<td><strong>1959-</strong> IPC worked with packers to identify ‘Packed in Idaho’ designation</td>
<td><strong>Continued</strong> improvements in molecular techniques to improve seed quality instead of relying solely on visual inspections</td>
</tr>
<tr>
<td><strong>1955-</strong> Patent filed for ‘GROWN in Idaho’ label</td>
<td><strong>1959-</strong> Seed and Plant Certification Act designated the Univ. of ID to assign an agent to conduct seed certification; ICIA was appointed</td>
<td><strong>2004-</strong> Tri-State potato commissions warrant Income Potential Feasibility Studies for royalty collections on potential Tri-State varieties</td>
</tr>
<tr>
<td><strong>1959-</strong> Seed and Plant Certification Act designated the Univ. of ID to assign an agent to conduct seed certification; ICIA was appointed</td>
<td><strong>1967-</strong> JR Simplot begins working with Ray Kroc to supply frozen French fries to McDonald’s</td>
<td><strong>2005-</strong> PVMI incorporated as non-profit, initiated by state potato commissions</td>
</tr>
</tbody>
</table>
Idaho Potato EGS System Key Takeaways

- Focus on marketing led to the creation of Idaho’s powerhouse potato market. The Idaho Fruit and Vegetable Advertising Commission began advertising Idaho potatoes in national magazines and was able to create a price premium for Idaho commercial potato growers of $1/cwt more than was received by other states. The evolution of the Commission into the Idaho Potato Commission (IPC; focused solely on potato promotion) in the 1950s allowed for more branding of products and increased consumer demand for Idaho-grown potatoes. Now, IPC manages the Idaho potato branding and marketing, but is also a voice for the industry when consumption is low domestically and internationally. This story of evolution of the marketing program is key to the success of the Idaho potato industry’s success.

- NSPP was formed when the realization of the value of quality tissue culture was starting to become mainstream, similar to how hydroponics is now starting to become mainstream. Demand for clean material by growers was rising, and the university realized that tissue culture was the answer to meet the demand. Jenny Durrin notes that there were a lot of regulations that came into play prior to NSPP’s creation and that certification became a necessity.

- The Tri-State Potato Breeding Program evolved from the existing USDA potato breeding program in Aberdeen. Potato breeding had been done previously by separate states and the USDA decided that by joining the forces of the three potato growing states and their research divisions, not only would the Aberdeen program reach greater success, but the whole industry would benefit from higher adoption of new varieties and elimination of redundancies across the programs.

- Irrigation of farmland played a large role in the evolution of the Idaho potato industry. Sprinklers allowed for irrigation that could be moved between fields and reduced irrigation runoff. It also made it possible to farm on rolling hills instead of just flat land. The Cary Act of 1894 contributed to the increased levels of irrigation by making one million acres of federal land available to states if they agreed to irrigate them for agricultural use. In Idaho, this allowed farmland that was previously only suited as range for cattle and sheep to be transitioned in to family potato farms.

- The state continually updates and revises seed laws that allows for improvements to be made that benefit farmers and the industry.
### NSPP Ebb-and-Flow System

**Previous System**

**New System**

<table>
<thead>
<tr>
<th>Method</th>
<th>Previous System</th>
<th>New System</th>
<th>New System Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Conventional 20’x100’ greenhouse with time-released fertilizer and irrigation; mini-tubers planted in gallon pots</td>
<td>Ebb-and-Flow System</td>
<td></td>
</tr>
<tr>
<td>Crops per Year</td>
<td>3</td>
<td>3, potential for 5 crops/year</td>
<td>Potential increase in crops/year is dependent on NSPP ability to secure additional greenhouse space</td>
</tr>
<tr>
<td>FTE Required for Production</td>
<td>3</td>
<td>3</td>
<td>No change in FTE required</td>
</tr>
<tr>
<td>Avg. Productivity</td>
<td>0.4lb of mini-tubers/pot</td>
<td>0.64lb of mini-tubers/pot</td>
<td>Yield increases average 60%, but one trial saw a 150% increase in yield (1 lb mini-tubers/pot)</td>
</tr>
<tr>
<td>Total Yearly Production</td>
<td>~5,000 lbs</td>
<td>~8,000 lbs</td>
<td>Total yearly production increases mirror productivity increases of 60%</td>
</tr>
<tr>
<td>Cost per Unit</td>
<td>$29.10</td>
<td>$19.06</td>
<td>35% decrease in cost/unit, after accounting for increases in yield and decreases in growing time</td>
</tr>
<tr>
<td>Profit</td>
<td>$3.90/lb</td>
<td>$13.94/lb</td>
<td>257% increase in profit, after accounting for increases in yield and decreases in growing time</td>
</tr>
<tr>
<td>Income per Year (at $33/lb mini-tuber)</td>
<td>~$165,000</td>
<td>~$264,000</td>
<td>Total yearly income increases mirror productivity increases of 60%</td>
</tr>
</tbody>
</table>

**THE BUSINESS CASE:**

- **Major Yield increases and Decreased in Growing Time**
  - 50-60% increase in mini-tuber yield per pot
  - 40% decrease in plant growing time - could do 5 crops per year, but constrained by the time needed in between crops for additional plantings
  - No longer need to rely on time released fertilizer and irrigation; this method means giving up consistency in size, but helps eliminate dormancy issues
  - Total cost is higher for ebb-and-flow, but increase in yield and decrease in time results in a more cost effective system

- **Ebb-and-Flow System Evolution**
  - The NSPP program runs completely off seed sales. The initial investment in the new system was made by the NSPP program pulling from it’s own funds
  - Prelim tests were run with two trays and increased following successes in productivity
  - Now, NSPP is requesting funding from the college to convert a larger greenhouse to all ebb-and-flow systems; the college will provide 20 4’x8’ tables & additional cold room storage and reservoirs; NSPP is responsible for all production costs (e.g. pots, growing media)

Source: Jenny Durrin, University of Idaho
Market Dynamics
The Tri-State Area Accounts for More than 60% of U.S. Potato Production

The U.S. Ranked 5th Globally for Total Potato Production in 2016

<table>
<thead>
<tr>
<th>#Country</th>
<th>2016 Production Total (tons)</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 China (incl. Taiwan)</td>
<td>109,034,662</td>
<td>27%</td>
</tr>
<tr>
<td>2 India</td>
<td>48,147,000</td>
<td>12%</td>
</tr>
<tr>
<td>3 Russia</td>
<td>34,218,577</td>
<td>8%</td>
</tr>
<tr>
<td>4 Ukraine</td>
<td>23,925,319</td>
<td>6%</td>
</tr>
<tr>
<td>5 United States</td>
<td>21,990,045</td>
<td>5%</td>
</tr>
<tr>
<td>6 Germany</td>
<td>11,849,310</td>
<td>3%</td>
</tr>
<tr>
<td>7 Bangladesh</td>
<td>10,421,509</td>
<td>3%</td>
</tr>
<tr>
<td>8 Poland</td>
<td>9,759,690</td>
<td>2%</td>
</tr>
<tr>
<td>9 France</td>
<td>7,518,148</td>
<td>2%</td>
</tr>
<tr>
<td>10 Netherlands</td>
<td>7,187,772</td>
<td>2%</td>
</tr>
<tr>
<td>11 Others</td>
<td>118,597,847</td>
<td>29%</td>
</tr>
<tr>
<td>Total</td>
<td>402,649,878</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: FAOSTAT

Idaho Consistently Ranks as #1 for U.S. Potato Production

2017 U.S. Potato Production (million cwt)

U.S. potato production value increased 23% from 2016 to 2017

Source: USDA NASS
The Majority of U.S. Potato Production Goes to the Processed Market, With the Fry Industry As the Leading Processed Market

2017 U.S. Major Potato Market Segments & Subsegments

- Processed 64%
- Fries 55%
- Dehydrated 16%
- Frozen Products 5%
- Chips 21%
- Other 3%
- Shrinkage 6%
- Seed 6%
- Fresh 25%

Source: USDA-NASS: Potatoes 2016 Summary, (Sept. 2017)- Adapted from University of Idaho and USDA-ARS Presentations

The strength of the fry market is a major driver for the Tri-State Potato Program’s variety development planning.

Four out of McDonald’s seven “gold standard” varieties are Tri-State developed varieties.

Commercial potato growers historically demand varieties that can be sold into the dominant processed market.

The Tri-State Program has delivered value by providing varieties with market-demanded characteristics.
Alternative Potato Health Benefits are Touted Throughout the Industry Hedge Against Consumer Preference Shifts

As a Demand-Driving Strategy, Entities from the Tri-State Potato Breeding Program to the Idaho Potato Council are Touting Lesser-Known Potato Health Benefit Information:

**Food Energy per Acre:**
- 75% more than wheat | 58% more than rice

**Vitamin C:**
- 45% of required daily value (for a medium-sized potato)

**Protein:**
- Approx. 50% more protein than wheat | Approx. 80% more protein than rice
- Good balance of amino acids
- Biological value of potato protein = 90-100 (chicken egg standard is 100)

**Phytonutrients/Anti-Oxidant Compounds**
- Polyphenols | Flavonoids | Carotenoids

Source: National Potato Council - Adapted from University of Idaho and USDA-ARS Presentations
Leadership
Idaho Potato Industry is Founded on Close Collaboration Between the University of Idaho and USDA-ARS in Variety Development

STRATEGIC OBJECTIVES

VARIETAL DEVELOPMENT & SEED DEPLOYMENT

Varietal Development

Varietal development for the Idaho EGS system is conducted through a close collaboration between the Tri-State Potato Breeding Program, which includes three universities (Idaho, Washington, and Oregon) and USDA-ARS researchers. USDA-ARS is the entity responsible for the breeding activities for the EGS system.

Seed Multiplication

Breeder seed production (seedling tubers) is managed by the USDA-ARS in Aberdeen, ID. Breeder seed multiplication is managed by the University of Idaho Nuclear Seed Potato Program in Moscow, ID, which provides foundation seed (nuclear seed) to ~30 early-stage certified seed growers.

Certified Seed Production

Certified seed production is performed by ~65 certified seed producers, which are further split into early-stage certified seed growers that generally do greenhouse increases and late-stage certified seed growers who manage in-field increases from the bulked-up early certified seed. Certified seed growers are often contracted by commercial growers for seed production.

FARMER PRODUCTION, MARKETING, AND KEY DEMAND SEGMENTS

Farm Production

In 2016, the U.S. ranked 5th globally for potato production. Idaho contributes more than one-third of the U.S. potato production each year on about 320,000 acres. Of this production, about 6% is produced for certified seed. The potato industry contributes about $4 billion to Idaho’s economy and provides more than 30,000 jobs.

Industry Advocacy

A main function of the Potato Variety Management Institute (PVMI) is managing the marketing and promotion of Tri-State varieties to potato growers in the U.S. and internationally; its activities are fully funded through royalty collections. Potato commissions in Idaho, Washington, and Oregon each exist to advocate for their individual potato industry growth and for their growers’ interests. The U.S. National Potato Council and Potatoes USA performs marketing and advocacy activities for the entire U.S. potato industry.

Demand Segments

The U.S. potato industry is dominated by the processing sector and specifically by the quick-serve restaurant fry industry. This industry drives the majority of demand planning decisions in the system. Other main demand segments include fresh-pack for table consumption, chip potatoes and an emerging market in specialty varieties (e.g. purple-flesh potatoes).

ENABLING ENVIRONMENT

Stakeholders

Tri-State Potato Breeding Program | PVMI | Idaho Crop Improvement Association | Idaho Potato Commission | Potatoes USA
Organizational Leadership by Value-Chain Step

- **Pre-Release**
  - ARS-Aberdeen & Prosser, Tri-State Universities

- **Breeder**
  - Contracted Basic Seed Growers

- **Certified (Early)**
  - Contracted Increase Seed Growers

- **Certified (Late)**
  - Potato Industry

- **Commercial**
  - Check-Off Fund Collection (First handler pays to US Potato Board)

- **Royalty Collection (PVMI)**
  - Seed inspection (Varies by state e.g., Idaho Crop Improvement Association)

- **Variatel Release**
  - (PVMI Manages Varieties from Tri-State Program)

- **Nuclear Seed Potato Program**
  - (Produces disease-free minitubers and plantlets)

- **Varietal Testing Trials**
  - (Statewide, Tri-State Area and Western Regional Trials)
## Organizational Value Chain Leadership Summary

<table>
<thead>
<tr>
<th>Organization</th>
<th>VALUE CHAIN ROLE</th>
<th>MAJOR FUNDING SOURCES</th>
<th>FINANCIAL SUSTAINABILITY</th>
</tr>
</thead>
</table>
| Northwest Potato Variety Development Program (Tri-State Program) USDA-ARS | • Varietal Development  
• Seedling Tuber Development  
• Early Field Trials  
• Disease Screening  
• Breeder Seed Maintenance | • Federal Funding  
• Extramural Grants | SUBSIDIZED BY THE PUBLIC & PRIVATE SECTOR |
| Nuclear Seed Potato Program | • Conduct Advanced Trials  
• Develop New Variety Management Profiles | • State Funding  
• NIFA grants  
• Private company funding  
• Check off funds to potato Commissions relayed to support research | FINANCIALLY SUSTAINABLE |
| Potato Variety Management Institute (PVMI) | • Nuclear seed production & sale  
• Virus clean up  
• Germplasm maintenance | • Royalties and licensing fees from Tri-State varieties  
• Certification fees  
• Lab testing fees | FINANCIALLY SUSTAINABLE |
| Idaho Crop Improvement Association | • Varietal licensing  
• Royalty collection  
• Tri-State variety marketing and public relations  
• Seed certification | | FINANCIALLY SUSTAINABLE |
| Certified Potato Seed Growers | • Feedback for varietal development  
• Potato Seed Production | • Sales of certified seed  
• Sales of commercial potatoes | FINANCIALLY SUSTAINABLE |
| Industry Support | | | FINANCIALLY SUSTAINABLE |
Frequent Communication Between Value Chain Actors Supports Product Development & Varietal Adoption

**LEADERSHIP**

**ORGANIZATION**

- **Northwest Potato Variety Development Program (Tri-State Program)**
  USDA-ARS

- **Nuclear Seed Potato Program**

- **Potato Variety Management Institute (PVMI)**

- **Idaho Crop Improvement Association**

- **Certified Potato Seed Growers**

- **Industry Support**

**Tri-State Program Variety Development**

- Industry provides feedback on breeder lines through their analysis of Fry Trial data, Tri-State Trials, Western Regional Trials, during early generation field selections, and through their own company trials.

- Certified seed growers order TC from NSPP one year in advance.

- Share disease information on new varieties.

- Variety Trial Data available to growers and processors industry.
Northwest (Tri-State) Potato Variety Development Program

Created in 1985 for breeding, development, and release of new potato varieties for Idaho, Oregon, and Washington

LEADERSHIP

Successful collaboration with 51 released varieties through PVMI

Five of these varieties are among the top 10 most widely grown in US

The research center at Aberdeen houses both USDA-ARS and University of Idaho researchers with defined roles:

1. Potato Breeding
   - Generates new potato hybrids
   - Produces seedling tubers-1st field generation
   - Field selection with industry/researchers
   - Early replicated field trial evaluations
   - Retain and advance or discard breeding clones

2. Plant Pathology
   - Screening for disease resistance
   - Maintenance of virus-free breeder seed

Aberdeen, ID Spotlight

Promising breeding clones from Aberdeen and Oregon/Washington are released as new Tri-State potato varieties
Nuclear Seed Potato Program

**Leadership**

The U of I Seed Potato Germplasm Program in the College of Agricultural and Life Sciences works to establish, maintain and distribute disease-free germplasm and mini-tubers for domestic and international seed potato growers and researchers.

**Virus Clean-Up**

**Plantlet Production**

**Mini-Tuber Production**

**Germplasm Maintenance & Variety Integrity**

**NSPP is Financially Sustainable:**

Sales of mini-tubers and plantlets to certified seed growers are the sole funding source of NSPP and cover all costs of operations.

**Total Income per Year:**

~$360,000

NSPP is the only source of all cleaned PVMI varieties for certified seed production.

**NSPP has a Far Reach:**

Mini-tubers and plantlets are shipped throughout the US and internationally:

- Canada
- Netherlands
- Germany
- United Kingdom
- South Korea
- Japan
- Australia
- China
- Jamaica
- Peru

60% of U.S. potatoes can be traced back to NSPP (pathogen eradication & plantlet and mini-tuber sales)

90% of potatoes in Idaho can be traced back to NSPP.

**Four Year Round Greenhouse Employees:**

Two FTE, Two HTE, 10 Student Employees
Potato Variety Management Institute

**Leadership**

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>Universities began protecting newly released cultivars</td>
</tr>
<tr>
<td>2004</td>
<td>Potato commissions order income feasibility study on protected cultivars</td>
</tr>
<tr>
<td>2005</td>
<td>PVMI incorporated as a non-profit organization</td>
</tr>
<tr>
<td>2006</td>
<td>State commissions contribute $225k to initiate PVMI; Business plan created</td>
</tr>
<tr>
<td>Current</td>
<td>Administers Tri-State varieties and manages global marketing efforts</td>
</tr>
</tbody>
</table>

PVMI’s main roles include:

**Administration:**
- Monitors PVMI seed growers
- Royalty and licensing fee collection
- Controls PVMI variety distribution
- Reports variety reports to board members

**Marketing & Public Relations:**
- Central contact point for PVMI varieties & growers
- Attends industry events
- Facilitates communication between industry and researchers
- Distributes marketing materials and press releases on new varieties

PVMI is Financially Sustainable:

Royalties and licensing fees **fund 100% of PVMI’s operations** and are collected from seed growers segmented by their growing location:

- Tri-States, 30%
- U.S. Outside of Tri-States, 40%
- Rest of the World, 30%

PVMI’s income is split between several streams of collections:

Any income collected beyond PVMI’s operational budget is **directed back toward the Tri-State Program** for continued research efforts.

Promote and administer the new Tri-State potato varieties to maximize their success and return revenues to support the Breeding and Research Program and benefit potato growers of Idaho, Oregon and Washington.
Idaho Crop Improvement Association

100% of Potato Seed Sold for Commercial Use in Idaho Must Be Certified Through ICIA

- Governed by 10-person board of directors & advisory committees for each commodity group
- Twelve seed potato inspectors cover the Idaho inspections; many of these are school teachers who have been inspecting for 20-30 years
- University of Idaho is the state’s main seed certification agency and oversees ICIA’s certification activities

Authority from:
Idaho Code 22-15 and IDAPA 08.05.01

ICIA seed certifiers reject ~1-2% of seed lots annually, as growers are very familiar with the strict certification guidelines that they must meet.

ICIA Crop Distribution

- Beans
- Potatoes
- Small Grain
- Grass
- Forage
- Misc.

Idaho Certified Acres Accepted

- All certified seed
- Certified potato seed acres

- 2013: 116,790
- 2014: 120,476
- 2015: 134,113
- 2016: 139,023
- 2017: 140,213

- 2013: 32,876
- 2014: 32,366
- 2015: 31,345
- 2016: 32,554
- 2017: 32,585

The Idaho Crop Improvement Association, Inc. was organized in 1940 by the certified seed growers of the State. The Idaho Seed Potato Growers Association voted to join the Idaho Crop Improvement Association, Inc. in 1942.
Research & Varietal Development
# Stage Gate Process – Breeding to Seed Deployment

10-to 15-year breeding process from cross to release:

<table>
<thead>
<tr>
<th>Breeding Phase</th>
<th>Varietal Testing Stage</th>
<th>Details</th>
<th>Location of Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1-2</td>
<td>Crossing 2 Generations</td>
<td>Generates breeding lines</td>
<td>USDA-ARS Aberdeen and Oregon State University</td>
</tr>
<tr>
<td></td>
<td>Cross to produce true seed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>True seed to seedling tubers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 3-7</td>
<td>Seed increases (Breeder to Foundation)</td>
<td>Year 3: 105,000 lines in single hill plots</td>
<td>YR 3: Aberdeen</td>
</tr>
<tr>
<td></td>
<td>See next slide for details</td>
<td>Year 4: 2-3,000 lines in 12-hill plots</td>
<td>YR 5: Swan Valley, ID</td>
</tr>
<tr>
<td></td>
<td>YR 5: 500 – 900 lines, 20 hills x 2 reps (yield, specific gravity, processing attributes, disease resistance)</td>
<td>Year 5-7: Tetonia</td>
<td></td>
</tr>
<tr>
<td>Year 8-12</td>
<td>Seed increases (Breeder to Foundation)</td>
<td>Statewide Trials are Replicated Trials that evaluate each state's new lines for targeted traits of interest</td>
<td>Idaho &amp; Oregon 3-4 locations</td>
</tr>
<tr>
<td></td>
<td>See next slide for details</td>
<td>All three universities test the same lines. WSU tests for post-harvest. Only Russets and specialty selections are made (no chippers).</td>
<td>Tri-State universities</td>
</tr>
<tr>
<td></td>
<td>YR 3-4: Aberdeen</td>
<td>Regional Yield Trials</td>
<td>WA, OR, ID, CA, CO, TX</td>
</tr>
<tr>
<td></td>
<td>YR 5: Swan Valley, ID</td>
<td>All three universities test the same lines. WSU tests for post-harvest. Only Russets and specialty selections are made (no chippers).</td>
<td>University of Idaho Nuclear Seed Potato Program</td>
</tr>
<tr>
<td></td>
<td>YR 6-7: Tetonia</td>
<td>Regional Yield Trials</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Occur for three years prior to release. Russets evaluated on early and late harvest management. All types of potatoes considered (includes chippers).</td>
<td></td>
</tr>
<tr>
<td>Year 12-15</td>
<td>Multiplication &amp; Clean Up</td>
<td>One year process for clean up and multiplication. TC testing usually occurs post-Tri-State Trials.</td>
<td></td>
</tr>
</tbody>
</table>

Foundation Seed & Certified Seed Available to Certified Seed Companies and Growers

Source: Conversations with Tri-State Potato Breeding Program Leaders; Tri-State Potato Breeding Program Presentations

**National Fry Processor Trials:** A Special Case of Industry Involvement

All breeding programs submit potato processing breeding clones for industry consideration on processing characteristics.

Six sites of the NFPT (WA, ID, ND, WI, ME, OR) give data on each of the new varieties, especially related to sensory information for processors.

Funded by USA Potatoes and lead processing companies.
RESEARCH & VARIETAL DEVELOPMENT

Variety Development and Seed Multiplication Schematic

- **GH Crossing**: 150-175 parental lines; true seed harvested
- **GH, Seedling Tubs, 160 – 175,000 seedling tubers; early selection**
- **Single Hill Plots**: Aberdeen and Teton, 1st field selections
- **12-Hill Plots**: Aberdeen & Teton, 2nd field selections: yield, specific gravity, processing attributes
- **G3 Tubers, Replicated Field Trials**: 20-Hills, 2 Reps, Aberdeen
- **Statewide Trials, ID & OR, 3-4 locations, replicated G4 – G6/G7 seed**

**Variety Development**

1. **YR1**: True seed
2. **YR2**: G1 Tubs from plots in GH
3. **YR3**: G2 Tubs from plots
4. **YR4**: Indexed Tubs to Swan Valley for G3 Seed
5. **YR5**: G3 to Teton, GH for G4 Seedling tubers
6. **YR6**: G4 to Oregon for Tri-State & Regional Trial Seed Production
7. **YR7**: Statewide Trials, ID & OR, 3-4 locations, replicated G4 – G6/G7 seed
8. **YR8**: Tri-State Trials
9. **YR9**: Regional Trials
10. **YR10**: Release Decisions
11. **YR11+:** Triggers NSPP Activity

**Seed Production**

- **TC Plantlets & mini-tubers**
- **NSPP**
Multiple Trials are Key to Developing New Tri-State Varieties

Data collected from trials throughout the selection process include fresh pack potential, processing characteristics (including frying), specific gravity, nutritional content, and post-harvest characteristics.

12 Hill Field Selections

Lab Testing for Processing Characteristics

Early Testing for Processing Characteristics in Statewide Trials

ACCEPTABLE FRYING AND CHIPPING RESULTS

UNACCEPTABLE FRYING AND CHIPPING RESULTS

Source: Tri-State Potato Breeding Program Presentations
The National Fry Processing Trial is a Public Private Partnership Solving Real World Issues

“The National Fry Processing Trial (NFPT) is a multi-year and multi-location national effort that aims at identifying new potato breeding lines with low acrylamide forming potential while maintaining or exceeding the outstanding agronomic quality and consumer acceptance found in current varieties” – PVMI Progress Bulletin

NFPT Originated to Meet Fry Industry Needs:

- 64% Of U.S. Potato Production is Used for Processing
- 55% Of U.S. Processed Potatoes Are Used for Frying

Ranger russet is the only variety in 50 years to become commercially successful outside of the French fry industry

National French Fry Processing Trial 2011
Acrylamide Results

<table>
<thead>
<tr>
<th>Clone/Variety</th>
<th>Nov 22, 2011</th>
<th>Feb 2, 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ID Mean</td>
<td>Nl Mean</td>
</tr>
<tr>
<td>VB152-1Trs</td>
<td>125</td>
<td>143</td>
</tr>
<tr>
<td>AC99375-1RU</td>
<td>198</td>
<td>88</td>
</tr>
<tr>
<td>W9804-1rs</td>
<td>240</td>
<td>193</td>
</tr>
<tr>
<td>W8743-1rs</td>
<td>135</td>
<td>210</td>
</tr>
<tr>
<td>AF3001-6</td>
<td>256</td>
<td>168</td>
</tr>
<tr>
<td>ND06755-4Rus</td>
<td>273</td>
<td>145</td>
</tr>
<tr>
<td>NK099461B-20Rus</td>
<td>225</td>
<td>248</td>
</tr>
<tr>
<td>WB360-1rs</td>
<td>218</td>
<td>300</td>
</tr>
<tr>
<td>Alturas</td>
<td>398</td>
<td>473</td>
</tr>
<tr>
<td>Burbank</td>
<td>1388</td>
<td>723</td>
</tr>
<tr>
<td>Highland Russet</td>
<td>616</td>
<td>719</td>
</tr>
<tr>
<td>AVE</td>
<td>385</td>
<td>418</td>
</tr>
</tbody>
</table>

* Selection procedures need to be implemented to select for French Fry QSR traits

To date, the NFPT has evaluated 180+ new breeding lines

Six NFPT locations report data: Idaho, Maine, North Dakota, Oregon, Washington, and Wisconsin

Tuber asparagine, sugar content, and acrylamide in fries after 1, 4, and 8 months of storage are evaluated in each line

Each year, selected clones are processed into fries at JR Simplot in Caldwell, ID and McCain Foods in New Brunswick, Canada where fries are evaluated using quick service restaurant (QSR) specifications for their consumer attributes

$250,000 budget is fully supported by the Potatoes USA and industry partners (including large potato processors and state potato commissions)

Source: National Coordinated Agricultural Project
Seed Multiplication Timeline

6-year process from Breeder Seed to Commercial Seed:

- **Year 10**: Multiplication and TC Clean Up at NSPP
- **Year 11**: Early Certified Seed Production (Foundation Seed)
- **Year 12-14**: Late Certified Seed Production (G1-G3)
- **Year 15**: Commercial Potato Production and Distribution

**Multiplication Phase**

**Breeder Seed to Foundation Seed Process:**
- **NSPP** is responsible for the clean up of tissue culture, breeder seed maintenance, and nuclear seed production
- **Certified seed producers** buy plantlets or mini-tubers from NSPP for planting into greenhouses or fields to begin on-farm multiplication
- Some seed growers bulk up NSPP plantlets and mini-tubers to sell to other seed growers. Others produce their own commercial crops from the NSPP seed

**Research & Varietal Development**

This timeframe is for an average variety. It may differ depending on the variety profiled.
PVMI Variety Descriptions

---Clearwater Russet Variety Details---

Clearwater Russet known as AOA95154-1 prior to release, is medium-late maturing, with oblong-long tubers that have medium-russet skin. Tubers exhibit excellent fry color out of storage and their attractiveness make this variety suitable for both processing and fresh market usage.

Clearwater Russet has high specific gravity and is resistant to sugar ends as well as most internal and external tuber defects. Clearwater Russet also is notable for having a higher protein content than those of standard potato varieties, with 38% greater concentration than Russet Burbank. Has moderate resistance to Verticillium.
The Tri-State Potato Breeding Program Makes National Headlines for New Variety Development

“Most of PVMI’s foreign royalties come from Australia. Gemstar Russet, a good processing variety released in the late 1990s, is Australia’s top Tri-State spud, though its susceptibility to PVY makes it less popular domestically.” —PotatoPro

New Northwest spuds offer strong disease resistance

Two potatoes that will be released by the Tri-State Potato Breeding Program in the Northwest should help growers cope with losses of effective fumigants, due to their strong resistance to diseases.

“The new Tri-State Potato Breeding Program varieties — Castle Russet and high-yielding Echo Russet — are billed as medium-to late-maturing potatoes appropriate for use in both the fresh market and processing. Testing has shown they also have good culinary qualities and cold sweetening resistance, so they fry with a light color even after months in storage.” —Capital Press
Demand Planning and Operations
# Early Generation Seed Deployment Model

<table>
<thead>
<tr>
<th>Who</th>
<th>Breeder Seed</th>
<th>Foundation (Nuclear) Seed</th>
<th>Certified Seed</th>
<th>Commercialization</th>
</tr>
</thead>
<tbody>
<tr>
<td>USDA-ARS</td>
<td>Nuclear Seed Potato Program</td>
<td>Independent Seed Growers</td>
<td>Independent Growers</td>
<td></td>
</tr>
<tr>
<td>Aberdeen, ID</td>
<td>University of Idaho (Moscow, ID)</td>
<td></td>
<td>Purchase seed from certified seed growers</td>
<td></td>
</tr>
<tr>
<td>Sector</td>
<td>Public</td>
<td>Public (but financially sustainable)</td>
<td>Private</td>
<td>Private</td>
</tr>
<tr>
<td>Input</td>
<td>80 lb. of Pre-Breeder Seed</td>
<td>800 lb. of Breeder Seed</td>
<td>8,000 lb. of mini-tuber, (200,000-250,000 Plantlets per year)</td>
<td>80,000 lb. Certified Mini-tuber Seed</td>
</tr>
<tr>
<td>Output</td>
<td>800 lb. Breeder mini-tuber Seed</td>
<td>8,000 lb. mini-tubers (Foundation Seed)</td>
<td>80,000 lb. Certified mini-tubers</td>
<td>49.5 billion pounds of Commercial Potatoes</td>
</tr>
</tbody>
</table>
| Capital Sources | • State Funding  
• NIFA grants  
• Private company funding  
• Check off funds | • Nuclear seed sales cover all costs of nuclear seed production | • Certified seed sales  
• NOTE: State potato commissions collect assessments to fund state marketing and potato research | • Commercial seed sales  
• NOTE: potatoes USA collects an assessment to fund marketing activities for all U.S. potato growers |
Flying A Ranch Spotlight

Follows a 4-Year Production Planning Cycle For Each Variety Going to Commercial Growers

<table>
<thead>
<tr>
<th>“Early” Certified Seed Producer</th>
<th>“Late” Certified Seed Producer</th>
<th>Sales of Certified Seed to Commercial Growers</th>
</tr>
</thead>
<tbody>
<tr>
<td>• GH mini-tuber production managed by Emma; purchases clean TC material from NSPP</td>
<td>• Laura grows a max of 6 varieties to ensure quality seed that will pass certification</td>
<td>• Commercial growers are contracted to large processors</td>
</tr>
<tr>
<td>• Built a 60’ X 80’ to generate their own EGS from PVMI varieties</td>
<td>• 300 clean clones/lines are maintained at NSPP following this process</td>
<td>• Most commercial growers work on short-term contracts, complicating the seed demand planning process</td>
</tr>
<tr>
<td>• Sole customer is their own on-farm certified seed production</td>
<td>• Solely a seed grower; perceives too much risk in mixing commercial and seed production</td>
<td>• QSR and fry industry drive the varietal adoption of Idaho potato growers</td>
</tr>
</tbody>
</table>

Owners:
Clen and Emma Atchley
Laura Pickard

Atchley Demand Planning Success Factors:

Evolved as an “early” certified seed grower to ensure they were receiving quality EGS for their seed operations. **Now, they only grow “early” certified seed for their own on-farm use.** This reduces the risk involved in selling to other seed growers including contract breaches and oversupply.

Flying A does not account for oversupply when planning for seed demand. This ensures each seed potato has a buyer, as quality losses from post-harvest storage make selling surplus seed potatoes to fresh pack channels difficult.

Flying A grows six varieties on 1,200 acres, which is viewed as the optimal capacity. Laura believes this is the capacity she can effectively manage at the quality needed without hiring additional help. Growing a moderate amount of varieties also helps with keeping disease pressure lower.
NSPP is Responsible for Cleaning-Up Promising Lines and Multiplying Breeder Seed to Nuclear Seed

**NSPP receives material from Tri-State Breeders**
- Material is available typically following 1st year of Regional Trials
- Industry is involved in selecting which varieties to clean and bulk for seed production

**NSPP cleans the lines using ribavirin & heat treatment**
- Cleaning process takes ~six months to one year to complete
- 300 clean clones/lines are maintained at NSPP following this process

**Copy of plantlet sent to ICIA for entry-level testing**
- PVY, PVA, PVX, PVS, PVM, PLRV, RLSV, PMTV, PSTVd, BRR, & Pectobacterium
- Testing re-occurs every 1-2 years depending on demand

**Plantlets bulked in GH & mini-tubers produced**
- 200,000-250,000 plantlets are produced in 20' X 100' greenhouses
- Three crops of mini-tubers produced per year for ~6,000 lb. of seed as Nuclear Field Plantings

**Mini-tubers sold to certified seed growers**
- Contracted NSPP production is done on a hand-shake basis with ~50 growers
- Director of NSPP is working on developing more strict contractual agreements

---

**Nuclear mini-tuber sales details:**
- **$9.50/cube** For 20 plantlets
- **$33/lb.** For mini-tubers with a 400-600 lb./acre planting rate
- **$0.50-$1/cutting** For a cut mini-tuber (micro-tuber)

---

**Context:**
- Previous year demand largely determines the upcoming demand for new varieties
- Growers asked in to place orders by December (two years in advance); Planting material available in April (no contracts in place)
- If grower fails to pick up order, they are required to pay for it as part of a handshake agreement
- Growers that fail to pay for orders are banned from ordering again
Royalty Fees and Licensing Overview

The following is required by seed growers when reporting royalties to PVMI:
• Written report of location, acreage, and number of units sold (cwt) of all licensed material produced or sold as seed
• Publish seed information in grower directory for their region
• Records should be retained for three years

Licenses, 12%
Royalties, 88%

Licensing Fee for Tri-State Varieties: $100 (Tri-State), $250 (Rest of U.S. International)
Royalties are paid annually on the units of seed sold (cwt) by the seed grower

Tri-State Growers:
$0.25/cwt
$1.00/cwt for specialty varieties

Rest of U.S.:
$0.50/cwt
$1.00/cwt for specialty varieties

Rest of World:
$1.00/cwt
$2.00/cwt for specialty varieties

Royalties and licensing fees cover PVMI's operations. All excess funding is directed back to the Tri-State Program's research efforts.

Licensing Agreements & Royalty Invoices are Available to Growers on the PVMI website
Financial Sustainability
Financial Sustainability by EGS Value-Chain Step

Varietal Development & Breeder Seed Management

Public sector contributes 80% of operating costs; private funding from PVMI and industry associations fund the other 20%

Nuclear Seed Production (Foundation Seed)

NSPP is fully funded by the sale of mini-tubers and plantlets to certified seed growers

Certified Seed Production

Commercial seed companies fund certified seed production through seed sales
Varietal Development & Breeder Seed Management Resourced Through Seven Channels; Public Sector Funds ~3/4 of Annual Operating Costs

<table>
<thead>
<tr>
<th>Funding Source</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARS Funding</td>
<td>$1,400,000</td>
</tr>
<tr>
<td>Check off Funds (ID Potato Commission, WA, and OR)</td>
<td>$168,000</td>
</tr>
<tr>
<td>NIFA Grants</td>
<td>$855,000</td>
</tr>
<tr>
<td>University Funding (Tri-State) – in-kind contribution of greenhouses</td>
<td></td>
</tr>
<tr>
<td>Royalty/Licensing Income</td>
<td>$393,041</td>
</tr>
<tr>
<td>Revenue from Seed Sales</td>
<td>$60,000</td>
</tr>
<tr>
<td>Sponsored Industry Research</td>
<td></td>
</tr>
</tbody>
</table>

Sources of Varietal Development & Breeder Seed Management Operational Funding

Funding Source Color Key:
- **Public Sector Source**
- **Private Sector Source**

- In kind use of university greenhouses

* "in kind use of university greenhouses"
The Cost of Nuclear Seed Production is Recouped Through the Sale of Mini Tubers to Seed Growers

- The Nuclear Seed Potato Program (NSPP) operates on a yearly production planning cycle and encourages growers to plan well in advance of immediate needs.
- Growers typically place orders in December to receive mini-tubers or plantlets by the next fall.
- Informal agreements for picking up and paying for seed exist in place of binding contracts. Self-regulation in adhering to the informal agreements is made effective on the basis of grower reputation being dependent on following through on ordering commitments.

### Nuclear Seed Potato Program

- **Mini-Tuber Production**

| a. Volume of Nuclear Mini Tubers Produced (lbs.) | 8,000 |
| b. Price Charged for Nuclear Mini Tubers (per lb.) | $33.00 |

**Mini Tuber Revenue**

- **Mini-Tuber Production**

| c. Volume of Nuclear Plantlets Produced | 200,000 |
| d. Price Charged Per Nuclear Plantlet | $0.50 |

**Nuclear Plantlet Revenue**

| Revenue from Nuclear Plant Sales | $364,000 |
Seed Growers Cultivate Over 32,500 Acres of Certified Seed, and Sell 976,500,000 lbs. of Production to Tri-State, US, and International Commercial Growers

Certified seed production is performed by ~65 certified seed producers, which are further split into early-stage certified seed growers that generally do greenhouse increases and late-stage certified seed growers who manage infield increases from the bulked-up early certified seed.

Certified seed growers are contracted by commercial growers for seed production.

<table>
<thead>
<tr>
<th>Certified Seed Growers</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Certified Seed Acres (Idaho)</td>
<td>32,550</td>
</tr>
<tr>
<td>b. Yield/ Acre (cwt)</td>
<td>300</td>
</tr>
<tr>
<td>c. Total Certified Seed Production (cwt) (a*b)</td>
<td>9,765,000</td>
</tr>
<tr>
<td>d. % Sold as Tri-State Certified Seed</td>
<td>25%</td>
</tr>
<tr>
<td>e. Total Certified Commercial Seed Sold (cwt) (a<em>b</em>c)</td>
<td>2,441,250</td>
</tr>
<tr>
<td>f. Seed Sold to Tri-State Growers</td>
<td>732,375</td>
</tr>
<tr>
<td>g. Seed Sold to Outside of Tri-State, Inside U.S.</td>
<td>976,500</td>
</tr>
<tr>
<td>h. Seed Sold to Outside of Tri-State, International</td>
<td>732,375</td>
</tr>
<tr>
<td>i. Average Price per cwt (Tri-State Growers)</td>
<td>$12</td>
</tr>
<tr>
<td>j. Average Price per cwt (Outside of Tri-State, Inside U.S.)</td>
<td>$12</td>
</tr>
<tr>
<td>k. Average Price per cwt (Outside of Tri-State, International)</td>
<td>$12</td>
</tr>
<tr>
<td><strong>Total Certified Seed Revenue (f<em>i + g</em>j + h*k)</strong></td>
<td><strong>$29,295,000</strong></td>
</tr>
</tbody>
</table>

SOURCE: Conversations with USDA-ARS researchers
Enabling Environment
Demand for Quality Seed Instituted a System of Sustainable Actors & Varietal Replacement

“"You can’t push a rope.""

Russet Burbank continues to be a dominant variety, but Tri-State varieties are quickly catching up in PNW acres planted due to perceived quality improvements.

PVMI licenses to ~80% of certified seed growers in Idaho despite public varieties being available and less expensive.

Potato grower interest in quality seed is so high that 100% of seed must now be certified in Idaho.

Nuclear seed production, certified seed production, new variety marketing, and royalty and licensing fee collection activities all function sustainably based on grower willingness to pay for quality seed.

SOURCE: Compiled from NASS; Data courtesy of Mark Pavek and Rick Knowles, WSU.
100% of Idaho Potato Seed is Inspected by Idaho Crop Improvement Association at Several Points of Production Before Certification

~75% of Idaho Potato Seed is Produced Within Seed Management Areas

Idaho Potato Seed Inspection Timeline

- **Summer**
  - Paperwork and Fees Paid
  - Minimum of two summer visual inspections per field
  - Checking for field requirements, identity and purity, phytosanitary tolerances

- **Fall**
  - 2 Summer Field Inspections
  - Sanitation: Pre-harvest, old crop, cleanliness
  - Storage inspection: Lot identity, co-mingling

- **Winter**
  - Storage & Harvest Inspection
  - Winter grow-out conducted in Hawaii
  - Lab testing (ELISA) for PVY and leaf roll done back in Idaho
  - BRR testing also completed
  - REQUIRED for final certification

- **Spring**
  - Post-Harvest Testing (Hawaii)
  - Federal-State Inspection Service
  - Considers conformity with seed potato grades

- **Shipping Point Inspection**

**ICIA Transparency Success Factors:**

- Field inspections and final certifications are completed by different personnel
- Returning seed inspectors do not certify the same fields year after year
- Idaho Dept. of Agriculture does final certification step at the shipping point
Winter Grow-Outs by ICIA in Hawaii Allow for Additional Disease Testing Absent of Extra Field Years

Hawaii Grow-Out Lots Tested For:

- PVY Presence
- Leaf Roll Presence

Each grower submits 400 tubers per lot to the Hawaii grow out to be tested for disease presence.

“We moved to Hawaii form California as a customer service to our growers. We can get them results more quickly which helps with their sales” – ICIA Area Manager

Idaho Crop Improvement Association’s winter grow-out used to be conducted in California, but was moved to Hawaii in 2018 to mitigate the risk of frost and have faster turnaround of seed health for growers.

The decision to move to Hawaii was made based on ICIA conversations with other states’ crop improvement associations that have had success growing through winter in Hawaii.
Idaho Potato Seed Generation System

<table>
<thead>
<tr>
<th>Field Year</th>
<th>Generation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Breeder – Crosses, Evaluation</td>
</tr>
<tr>
<td></td>
<td>Tissue culture/Virus Elimination</td>
</tr>
<tr>
<td>0</td>
<td>Tissue culture, greenhouse production</td>
</tr>
<tr>
<td>1</td>
<td>Field Production: PVX-Nuclear</td>
</tr>
<tr>
<td>2</td>
<td>PVX-G1</td>
</tr>
<tr>
<td>3</td>
<td>PVX-G2</td>
</tr>
<tr>
<td>4</td>
<td>G3</td>
</tr>
<tr>
<td>5</td>
<td>G4</td>
</tr>
<tr>
<td>6</td>
<td>G5</td>
</tr>
<tr>
<td>7</td>
<td>G6</td>
</tr>
</tbody>
</table>

- **Originating Institution/University**
- **University/Early Generation Growers**
- **Sale for additional seed increase**
- **Sale for Commercial Production**

**Downgrade/Flush out**

Source: ICIA Presentation
The Idaho Seed Potato Law was enacted by the Idaho State Legislature in 1996 largely in response to a nationwide task force that recommended mandatory seed laws as a way to combat bacterial ring rot outbreaks. Idaho potato growers through the Idaho Potato Commission were the catalyst for this change. The law reads:

“All potatoes offered for sale, sold or delivered under contract or distributed into or within the state of Idaho for planting in the state of Idaho by any person from any state, territory, or country shall be certified and shall be accompanied by a certificate of inspection and a plant health certificate, and shall include the description of the grade, the findings of all inspections of each lot of seed, noting the name and amount of any disease observed, and generation of the potatoes and shall show that the potatoes were packed, sealed, and tagged under the certification standards of the state, territory, or country in which they were produced.”
University of Idaho Provides Management Bulletins for All PVMI Varieties as a Service to the Industry

Jeff Stark (University of Idaho) and Mark Pavek (University of Washington) prepare management bulletins for each variety that is released from Tri-State into the PVMI marketing program. Management data is collected during Tri-State Trials by university researchers. Each bulletin is posted on the PVMI website and accompanies the variety description and certified seed grower list.

Management Bulletins Address Grower Concerns On:

- Seed and Pests
- Nutrients
- Irrigation
- Storage
- Harvest

---

**Clearwater Russet**

A new dual purpose russet with high protein and excellent processing qualities

### Characteristics

- High N, V, O, K
- Specific Gravity
- Attraction Factor
- Eye Color
- High Protein Content

### Disease Resistance

- Verticillium and rot resistant
- Colletotrichum and rot resistant
- PVX and rot resistant
- PMV and rot resistant
- Late blight resistant
- Early blight resistant
- Root knot nematode resistant

---

**Management**

**Seed and Pests**

- Some Thrips

**Additional**

- More resistant to bacterial scab in the Columbia Basin
- 2019/2021, Spring, WA

---

**Cultural Requirements**

- Average or below average rainfall
- Good drainage
- Average or below average rainfall
- Good drainage

---

**PVMI Website**

[www.pvmi.org](http://www.pvmi.org)

---

The recommendation is constrained within the Tri-State area under the Tri-State Potato Grower Research and Development Program and this document.
## Financial Enabling Environment

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>DETAIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Commodity Price Hedge</td>
<td><strong>Price Loss Coverage (PLC):</strong> Producers who hold base acres of wheat, feed grains, rice, oilseeds, peanuts, and pulses (covered commodities) are eligible to enroll in the PLC program on a commodity-by-commodity basis. Payments are made when market prices fall below the reference price set in the 2014 Farm Act.</td>
</tr>
<tr>
<td>Regional Commodity Price Hedge</td>
<td><strong>Agriculture Risk Coverage (ARC):</strong> Producers who hold base acres of rice, wheat, feed grains, oilseeds, peanuts, and pulses (covered commodities), are eligible to enroll in ARC on a county or individual farm basis. County ARC payments are made when county crop revenue for the enrolled commodity drops below 86 percent of the county benchmark revenue. Individual ARC payments are made when the actual individual crop revenues—summed across all covered commodities on the ARC farm—are less than 86 percent of the ARC individual benchmark revenue.</td>
</tr>
<tr>
<td>Commodity Marketing Credit</td>
<td><strong>Marketing Assistance Loan Program:</strong> A post-harvest nonrecourse commodity loan program with marketing loan provisions for producers of wheat, corn, grain sorghum, barley, oats, upland cotton, extra-long staple (ELS) cotton, long- and medium-grain rice, soybeans, other oilseeds, peanuts, wool, mohair, honey, dry peas, lentils, and small and large chickpeas. When the adjusted world price for rice (as calculated weekly by USDA), falls below loan rates, marketing loan provisions allow for repayment of loans at the lower price and for loan deficiency payments to producers who choose not to place commodities under loan.</td>
</tr>
<tr>
<td>National Crop Insurance</td>
<td><strong>Traditional crop insurance:</strong> Producers can purchase insurance policies at a subsidized rate under Federal crop insurance programs. These insurance policies make indemnity payments to producers based on current losses related to either below-average yields (crop yield insurance), or below-average revenue (revenue insurance). Both yield and revenue insurance options are available.</td>
</tr>
</tbody>
</table>

*Source: USDA ERS*
Thank you for your time and support in the development of this Idaho Potato EGS profile.

## Stakeholders Consulted

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Rich Novy</td>
<td>Research Geneticist</td>
<td>USDA-ARS</td>
</tr>
<tr>
<td>Dr. Jonathan Whitworth</td>
<td>Research Plant Pathologist</td>
<td>USDA-ARS</td>
</tr>
<tr>
<td>Dr. Jeff Stark</td>
<td>Superintendent</td>
<td>University of Idaho Aberdeen Research &amp; Extension Center</td>
</tr>
<tr>
<td>Emma Atchley and Laura Pickard</td>
<td>Idaho Seed Growing Family</td>
<td>Flying A Ranch</td>
</tr>
<tr>
<td>Richie Toevs</td>
<td>Idaho Seed Grower</td>
<td>Toevs Farm LLC</td>
</tr>
<tr>
<td>Jennie Durrin</td>
<td>Director</td>
<td>University of Idaho Nuclear Seed Potato Program</td>
</tr>
<tr>
<td>Dr. Ben Eborn</td>
<td>Extension Agricultural Economist</td>
<td>University of Idaho</td>
</tr>
<tr>
<td>Paul Patterson</td>
<td>Agricultural Economist (retired)</td>
<td>University of Idaho</td>
</tr>
<tr>
<td>Alan Westra</td>
<td>Area Manager</td>
<td>Idaho Crop Improvement Association</td>
</tr>
<tr>
<td>Todd Carter</td>
<td>Superintendent</td>
<td>University of Idaho Tetonia Research &amp; Extension Center</td>
</tr>
</tbody>
</table>
thank you