TRENDS IN POTATO CONSUMPTION AND MARKETS

TECHNICAL SESSION B
Adoption and Impacts of Potato Variety Cooperation 88 (C88) in Yunnan, China: A Multi-dimensional Assessment

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Background

➢ China

➢ Largest potato producer in the world
➢ Government supports expanded production of potatoes as staple food
➢ Demand for processed potatoes is increasing

➢ Yunnan Province

➢ 10% of Chinese potato production
➢ Mountainous, high humidity, two main production seasons
➢ Major problems with late blight, low applications of fungicides
Background

➢ Cooperation88 is a high quality, high-yielding late blight resistant variety, valued by the growing potato processing industry

➢ Developed out of a collaboration between CIP and Yunnan Normal University (YNU)
  ➢ 1986: YNU and CIP partnered to select superior clones for late blight resistance
  ➢ Vietnamese graduate student in Philippines began breeding for late blight resistance using CIP parent materials
  ➢ Extra true potato seed from Philippines work was provided to Yunnan project: 8,000 seeds from 17 crosses evaluated beginning in 1990 at Huize county experiment station
  ➢ 1995: C88 passed all locational and provincial trials

➢ 1996: C88 named and diffusion began; officially released in 2001

➢ 2010: C88 area estimated at ~ 400,000 hectares

➢ “Among CIP’s biggest varietal successes to date”
Motivation & Objectives

➢ A strong interest in understanding the drivers of C88 success
  ➢ Late blight resistance
  ➢ Processing attributes and demand for inputs by processors
  ➢ Consumer demand growth
  ➢ Development of potato value chain and rural intensification
  ➢ Government policies

➢ Study objectives:
  ➢ Obtain rigorous estimates of adoption of potato varieties in Yunnan
  ➢ Estimate economic impacts of C88 diffusion on producers and consumers by comparing yields and costs to those of varieties it replaced
  ➢ Estimate market-level impacts of C88 by examining benefits along the value chain
    • Analyze how the potato seed input chain affects adoption and diffusion
    • Distribution of benefits between the processed and fresh potato markets
Methods

➢ Expert opinion workshops to measure national and provincial adoption
➢ Household and community surveys
➢ DNA fingerprinting to confirm identity
➢ Statistical analysis to identify and analyze determinants of adoption and dis-adoption (why C88 spread)
➢ Economic measurement of market benefits
➢ Participatory value-chain structured interviews and workshop
Expert estimates: Chinese potato areas and CIP contribution (12 Provinces)

Source: expert opinion elicitation, 2014
Estimation of C88 area by season in Yunnan

<table>
<thead>
<tr>
<th>Season</th>
<th>Crop Area (Ha)</th>
<th>C88</th>
<th>C88 Area (Ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EARLY SPRING</td>
<td>86,667</td>
<td>26.9%</td>
<td>23,333</td>
</tr>
<tr>
<td>LATE SPRING</td>
<td>396,667</td>
<td>16.7%</td>
<td>66,243</td>
</tr>
<tr>
<td>AUTUMN</td>
<td>43,333</td>
<td>7.7%</td>
<td>3,333</td>
</tr>
<tr>
<td>WINTER</td>
<td>60,000</td>
<td>55.6%</td>
<td>33,333</td>
</tr>
</tbody>
</table>

586,667          126,242

Source: Expert elicitation workshop, March 2015
Villages sampled per Prefecture

- No villages
- 1-2 villages
- 3-5 villages
- >5 villages
YNU report (on DNA fingerprinting) highlights

➢ 616 households surveyed, 141 mentioned planting C88.
➢ Based on visual observation, only one tuber sample of the C-88 collected from Zhanyi county city was found to be mixed with another red-skin cultivar.
➢ According to the results of cytoplasmic type detection, one leaf sample collected from Ninglang county of Lijiang city had different cytoplasmic type (T/β type).
➢ Additionally, the SSR marker-based fingerprinting further clarified three samples showed different SSR genotypes at two loci (STM1049 and STM3032a) in comparison with other samples and the reference C-88.
➢ Therefore, it was confirmed that over 97% (137/141) of the fresh samples (leaves and tubers) were C-88.
Adoption of major potato varieties in Yunnan (late-Spring 2015)

<table>
<thead>
<tr>
<th>Variety</th>
<th>Variety name in Chinese</th>
<th>Adoption rate (%)</th>
<th>% Households adopted</th>
<th># Dominated villages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooperation-88</td>
<td>合作88</td>
<td>18.9</td>
<td>23.2</td>
<td>9</td>
</tr>
<tr>
<td>Hui-2</td>
<td>会-2</td>
<td>22.7</td>
<td>26.1</td>
<td>10</td>
</tr>
<tr>
<td>Weiyu-3</td>
<td>威芋3号</td>
<td>16.1</td>
<td>18.2</td>
<td>7</td>
</tr>
<tr>
<td>Xuanshu-2</td>
<td>宣薯2号</td>
<td>6.2</td>
<td>8.8</td>
<td>3</td>
</tr>
<tr>
<td>Mira</td>
<td>米拉</td>
<td>13.7</td>
<td>16.6</td>
<td>7</td>
</tr>
<tr>
<td>Qingshu-9</td>
<td>青薯9号</td>
<td>3.9</td>
<td>9.3</td>
<td>1</td>
</tr>
<tr>
<td>Lishu-6</td>
<td>丽薯6号</td>
<td>3.3</td>
<td>4.2</td>
<td>1</td>
</tr>
<tr>
<td>Lishu-7</td>
<td>丽薯7号</td>
<td>5.4</td>
<td>6.8</td>
<td>3</td>
</tr>
<tr>
<td>Gamma-2</td>
<td>伽马2号</td>
<td>1.2</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>other</td>
<td></td>
<td>8.7</td>
<td>14.3</td>
<td></td>
</tr>
</tbody>
</table>
Diffusion over time

Percent of Farmers in Yunnan Who Have Ever Grown C88 by Year
Choice of variety for households who discontinued planting C88

<table>
<thead>
<tr>
<th>Variety</th>
<th># HHs growing</th>
<th>% of HHs stopped</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hui-2</td>
<td>45</td>
<td>34.1</td>
</tr>
<tr>
<td>Weiyu-3</td>
<td>6</td>
<td>4.5</td>
</tr>
<tr>
<td>Xuanshu-2</td>
<td>20</td>
<td>15.2</td>
</tr>
<tr>
<td>Mira</td>
<td>21</td>
<td>15.9</td>
</tr>
<tr>
<td>Qingshu-9</td>
<td>10</td>
<td>7.6</td>
</tr>
<tr>
<td>Lishu-6</td>
<td>15</td>
<td>11.4</td>
</tr>
<tr>
<td>Lishu-7</td>
<td>22</td>
<td>16.7</td>
</tr>
<tr>
<td>Gamma-2</td>
<td>9</td>
<td>6.8</td>
</tr>
<tr>
<td>Other</td>
<td>17</td>
<td>12.9</td>
</tr>
</tbody>
</table>
Following factors are positively associated with adoption of C88 and negatively associated with disadoption

- HH characteristics: Size, education, farming is primary occupation
- Farm characteristics: farm size, frequency of connections with extension
- Attitudes about late blight
- Village characteristics: Distance to county center, village has farmer organizations

Negatively associated with adoption and positively associated with disadoption

- Dependency (relatively few people of working age in household)
- Elevation
Pathways to economic impact: Productivity changes associated with C88

- Village level surveys were used to build representative cost of production budgets for C88 and the counterfactual.
- % change in costs of production between C88 and control:
  - Detailed probing indicated no cost differential
  - Quality seeds not available in markets; usually provided free
  - Farmers do not vary production processes by variety
- Yield and total production from HH survey
  - Compared to village survey yield estimates
  - Household-level regression: 26% difference in productivity with C88 compared to alternative
Summary: Economic impacts

➢ Depending on assumptions, between USD 2.8-3.7 billion in total economic surplus gained over 19-years studied

➢ Robust to alternative assumptions—benefits are large under any plausible scenario

➢ Under closed market assumption: 61% of gains go to consumers & 39% go to producers

➢ Benefits are greater in closed market scenario compared to small open economy

➢ Looking into future: Benefits are shrinking as area shrinks

➢ Access to seeds (and promotion by key players) helped determine quick spread (and diminished share in future)
Value chain analysis

➢ C88 is associated with rural intensification and growth of processed potato industry
➢ Transformation of agriculture has occurred, particularly in winter-growing areas
➢ Adoption reached its peak in 2010 and has steadily fallen since then
➢ Availability of clean seed is a major obstacle to increased impact and continued adoption
➢ Government has played a key role promoting industry development (seed production is still lagging)
Seed degeneration problem

- Hypothesis: lack of clean seed of C88 responsible for more than 25% yield loss; lack of clean seed responsible for declining c88 area
- Included questions to understand when farmers obtained clean seed for the last time and yield loss during the period
- Approximately 300 responses, additional analysis to be conducted with CIP pathologists
Thank you