Agriculture Producer's Willingness-to-Pay for Broadband Upload Speed

Research Update
Jacob Manlove
Arkansas State University
Use of Broadband In Agriculture

Connected Technologies in Row Crops

• Planning
  • Yield Monitoring: Combine-mounted monitors gather harvest data for business decisions.
  • Precision Seeding: Location-tagged field data can be uploaded into planning software to optimize planting decisions and placement.
  • Micro-climate Monitoring: Satellites or on-site weather stations can forecast local weather more accurately, avoid potential pest problems, and reduce crop loss by up to 80%.

• Production
  • Connected Equipment Guidance: Vehicles, including autonomous vehicles, use GPS to determine field boundaries for precise tending.
  • Remote Diagnostics and Predictive Maintenance: Connected hardware and software diagnose and even anticipate needs for repair.
  • Variable Rate Applications: Technologies apply precise, optimal levels of raw inputs.
  • Field Scouting: Drone imagery and software can collect nutritional and growth data used to calculate optimal inputs.
  • Machine Learning and Visioning: Connected camera and software can identify weeds, detect disease with 90% to 99% accuracy, and locate local pests.

• Market Coordination
  • Storage Monitoring: Temperature and moisture sensors can detect storage quality for harvested products, reducing crop loss and increasing sale price.
  • Small Producer Coordination: Web platforms connect farmers directly to buyers, allowing them to earn premiums for meeting specific quality standards.
In this section, we describe the attributes of an Internet plan: Price, Reliability, Upload Speed, and Download speed. We also explain how these three features may affect your production operations. You may find this information helpful when answering questions in the next section.

- **Price**: The total monthly fee you pay for Internet service before tax.
- **Reliability**: The probability that a product, system, or service will perform its intended function adequately for a specified period of time, or will operate in a defined environment without failure.
- **Upload Speed**: The rate that data is transferred from the user’s computer to the Internet.
- **Download Speed**: The rate at which data is transferred from the Internet to the user’s computer.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Levels</th>
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<tbody>
<tr>
<td>Price</td>
<td>$45, $75, $105</td>
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<tr>
<td>Reliability</td>
<td>Less Reliable, Somewhat Reliable, More Reliable</td>
</tr>
<tr>
<td>Upload Speed</td>
<td>3 Mbps, 10 Mbps, 50 Mbps</td>
</tr>
<tr>
<td>Download Speed</td>
<td>25 Mbps, 100 Mbps, 980 Mbps</td>
</tr>
</tbody>
</table>
Which of the following internet connections do you prefer?

Option A
- Price: $75
- Reliability: More Reliable
- Download Speed: 25 Mbps
- Upload Speed: 50 Mbps

Option B
- Price: $45
- Reliability: Somewhat Reliable
- Download Speed: 980 Mbps
- Upload Speed: 10 Mbps

Option C
- Niether A or B is preferred.

16 Choice Sets from a full factorial of 81
How important do you believe the use of internet is to the successful operation of your business?

In the context of internet use for agricultural production, choose each of the following reasons for which you would use an internet connection.
Discrete Choice Model

Random Utility Model

\[ V_{ij} = \beta_1 Price_j + \beta_2 Upload Speed_j + \beta_3 Download Speed_j + \beta_4 Reliability_j + \epsilon_{ij} \]

### Conditional Logit Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std Err</th>
<th>p-value</th>
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</thead>
<tbody>
<tr>
<td>Price</td>
<td>-0.0260</td>
<td>0.0054</td>
<td>0.000***</td>
</tr>
<tr>
<td>Download Speed</td>
<td>0.0003</td>
<td>0.0003</td>
<td>0.306</td>
</tr>
<tr>
<td>Upload Speed</td>
<td>0.0122</td>
<td>0.0053</td>
<td>0.022**</td>
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<tr>
<td>Less Reliable</td>
<td>0.2313</td>
<td>0.5233</td>
<td>0.658</td>
</tr>
<tr>
<td>Somewhat Reliable</td>
<td>0.7241</td>
<td>0.4711</td>
<td>0.124</td>
</tr>
<tr>
<td>More Reliable</td>
<td>2.5805</td>
<td>0.4812</td>
<td>0.000***</td>
</tr>
</tbody>
</table>

Pseudo R² = 0.259

N = 47
Random Utility Model

\[ WTP_{\text{Upload \ Speed}} = 0.47/\text{Mbps} \]

\[ WTP_{\text{Download \ Speed}} = 0.01/\text{Mbps} \]

<table>
<thead>
<tr>
<th></th>
<th>WTP</th>
<th>Corn</th>
<th>Soybeans</th>
<th>Rice</th>
<th>Speciality</th>
<th>All</th>
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<tr>
<td>Upload</td>
<td>$0.395</td>
<td>$0.415</td>
<td>$0.387</td>
<td>$0.590</td>
<td>$0.470</td>
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<tr>
<td>Download</td>
<td>$0.019</td>
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<td>$0.023</td>
<td>$0.004</td>
<td>$0.010</td>
<td></td>
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</table>
Future Iterations:

- WTP for All Crops
- Inclusion of Demographic/Farm Variables
  - Age
  - Full-time vs Part-time producers
  - Total Acres Farmed
  - Farm Sales
- Impact of Use of Broadband on WTP
  - Marketing
  - News
  - Email
  - Etc.

Concerns:

- Low predictive power of model – more observations being collected
- Understanding of Attributes
I HOPE YOU ARE STAYING SAFE AMIDST THIS GLOBAL PANDEMIC!

I AM
BEN POSADAS
AN EXTENSION AND RESEARCH MARINE ECONOMIST
POTENTIAL OF POND GROW-OUT OF SOFTSHELL BLUE CRABS

Benedict ‘Ben’ Posadas, Ph.D.
Mississippi State University
Coastal Research and Extension Center
Mississippi-Alabama Sea Grant Consortium

https://coastal.msstate.edu/marine-economics
ACKNOWLEDGEMENT

This presentation is a contribution of the Mississippi Agricultural and Forestry Experiment Station. This material is based upon work that is supported in part by the National Institute of Food and Agriculture, U.S. Department of Agriculture, Hatch project under accession number 081730 and National Sea Grant College Program.
GOOGLE SEARCH – “SOFT BLUE CRABS”

THIS IS ONE OF THE RESULTS THAT I GOT WHEN I DID THE GOOGLE SEARCH.

Raw Domestic Soft Shell Crabs (12 Ct. Jumbos) - Frozen 1291020
Brand: Handy Seafood
Price: $129.00 ($10.75 / Count) + $39.99 shipping

Get $50 off instantly: Pay $79.00 $129.00 upon approval for the Amazon Rewards Visa Card. No annual fee.

This item is non-returnable
- 12 Crabs Total
- Cryogenically frozen for fresh taste.
- Frozen & Raw
- Multiple Cooking Options
- DNA Tested

$129.00
+ $39.99 shipping
Arrives: Oct 15 - 19
Fastest delivery: Thursday, Oct 15

In stock.
Usually ships within 3 to 4 days.
Qty: 1

Add to Cart
Buy Now

Secure transaction
Ships from Today Gourmet Food...
Sold by Today Gourmet Food...
The annual U.S. commercial landings hovered at its lowest around TWO MILLION POUNDS lately while dockside prices averaged over $3.50 per pound.
BLUE CRABS, SOFTSHELL, PER DOZEN, FOB M-A SINCE 2018

SAvg $/dozen

- Whales
- Jumbos
- Prime
- Hotel

2020 ECONOMIC IMPACTS ON U.S. BLUE CRAB MARKETS.
https://youtu.be/ZVUTzykRrWg
THESE MARKET CONDITIONS AND SUPPLY CONSTRAINTS PROVIDED AN ECONOMIC OPPORTUNITY FOR ENTERPRISING RESEARCH SCIENTISTS, SEAFOOD DEALERS, AND EXTENSION SPECIALISTS.
• University of Southern Mississippi, Ocean Springs, MS – blue crab hatchery and nursery and pond grow-out
• North Carolina Sea Grant Program –
• Carteret Community College, Carteret, NC – blue crab hatchery and nursery, pond grow-out
• Carteret Seafood Company, Beaufort, NC – pond grow-out, shedding facility, storage, and marketing
• Mississippi State University, Coastal Research and Extension Center, Biloxi, MS – aquaculture economics and marketing
ABSTRACT

Economic simulations are useful in guiding decision-making concerning the planning and managing pilot demonstration softshell blue crab ponds grow-out experiments to maximize harvests and improve profitability. The potential costs and benefits of the decision are weighed in advance before implementing any planned changes. In making these simulations, the current information and data on softshell blue crab production are used. The North Carolina model in pond preparation and the Mississippi data on stocking and survival were combined to create a hypothetical blue crab farm. The key assumptions include three crops per year and four, quarter-acres ponds. The stocking density is at first set at 2,000 juvenile crabs per pond and then raised to 3000, 4000, and 6000 juveniles per pond. Survival rates are initially pegged at 50 percent. Economic simulations initially considered the cost of juvenile crabs as being produced by private hatcheries and nurseries as this new industry starts to emerge. In the initial stages of industry development, critical state and federal assistance are provided to enable the emerging industry to take off. Additional simulations cover the impacts of increasing survival rates and growth rates. There are always trade-offs between stocking densities, survival rates, and growth rates. These relationships are sometimes muddled by the presence of predators, and the incidence of aquatic diseases. These situations are handled by adding a risk and uncertainty component. These are two sides to interpreting the simulation results. High juvenile prices increase pond growers' production costs. Expensive juveniles restrict the expansion of grow-out operations. On the other hand, high potential earnings encourage the hatchery and nursery owner/operator to grow his business. Finally, simulation results of production costs are compared to long-term variability in the wholesale prices of blue softshell crabs in the Mid-Atlantic U.S. markets.
POND GROW-OUT SYSTEMS

COASTAL NORTH CAROLINA
- Newly-built ponds
- Quarter acres
- Three feet water depth
- Brackish water
- Inlet canal
- Water pump

INLAND MISSISSIPPI
- Existing ponds
- Quarter acres
- Three feet water depth
- Zero salinity
- Artificial salt
- Water well and pump
COASTAL PONDS: BEAUFORT, NORTH CAROLINA

- Privately-owned
- Newly-built ponds
- Quarter acres
- Three feet water depth

- Brackish water
- Inlet canal
- Water pump
INLAND PONDS: LYMAN, MISSISSIPPI

- State-owned
- Existing ponds
- Quarter acres
- Three feet water depth
- Zero salinity
- Artificial salt
- Water well and pump
WATER PUMP AND DRAINAGE
BLUE CRAB JUVENILES STOCKED IN PONDS
SOFT-SHELL CRABS HARVESTED AFTER 45 DAYS FROM STOCKING IN THE PONDS.

FDRS 2020: POTENTIAL OF POND GROW-OUT OF SOFTSHELL BLUE CRABS
SENSITIVITY OF AVERAGE COST TO SURVIVAL RATE AT STOCKING = 2000 PER POND AND GROWTH RATE = 1.5 GRAM
Sensitivity of average cost to cost of juveniles at stocking = 4,000 and survival = 50%.
SOFT SHELL CRABS, HOTELS

2020 Wholesale price per dozen.
$15 \leq WP \leq $24

“HOTEL” soft blue crabs are 4 - 4½ inches in length or 2.5 oz in weight.

There are 15 dozens per case.

2020 ECONOMIC IMPACTS ON U.S. BLUE CRAB MARKETS. https://youtu.be/ZVUTzykRrWg
SOFT SHELL CRABS, PRIME

2020 Wholesale price per dozen. $26 ≤ WP ≤ $38

• “PRIME” soft blue crabs are 4½ - 5 inches in length or 3.3 oz in weight.

• There are 12 dozens per case.

2020 ECONOMIC IMPACTS ON U.S. BLUE CRAB MARKETS. https://youtu.be/ZVUTzykRrWg
RESEARCH IMPLICATIONS

• Private hatcheries and nurseries – stable supply, lower costs

• Stocking densities – quantity, size, and timing

• Managing survival and growth – more than 50 percent and larger crab sizes

• Feeds and feeding – local supply and lower costs

• Harvesting methods – detecting shedders and more efficient

https://www.fdrsinc.org/2020-virtual-conference/
2020 FDRS Virtual Conference

- Research Report
- Producer Issues and Decisions
Understanding Profitability of Georgia Blueberry Growers Adopting a Stochastic Approach

S. R. Kunwar¹, E. G. Fonsah², O. A. Ramirez², C. L. Escalante² & C. E. Landry²

¹Department of Agricultural and Consumer Economics, The University of Illinois at Urbana-Champaign
²Department of Agricultural and Applied Economics, The University of Georgia
Now

- Backgrounds
- Methodology
- Results and Discussions
- Summary and Conclusions
- Limitations
Can we say...with 100%?

- head or tail flipping up the coin
- will there be any pandemic in 2025
- the price of the wheat next year
- about rainfall next week

Certainly not
Why stochastic approach in agriculture?

- Agriculture performs in varying environment
- Mercurial nature of production components as difficult to define
- Many inherent randomness and uncertainties in the agriculture
- Example: disease, weather, price, yield, pest, etc.
- Planning in an uncertain environment is risk
Blueberry growers are facing price and yield alteration (Fonsah et al., 2007)

Both underestimation and overestimation of profit lead discomfort among farmers on investing in agriculture (Awondo et al., 2017)

A more sophisticated budget provides actual shape of profit and gears towards the expected returns
Backgrounds

Objectives

Overall objective:
• Evaluate profitability of Georgia blueberry using Stochastic budget

Specific Objectives:
• Develop deterministic budget of Georgia blueberry for 2020
• Extend deterministic budget to stochastic budget
• Contrast two different budgets
Now

• Background
• **Methodology**
• Results and Discussions
• Summary and Conclusions
• Limitations
Deterministic budget: Components

**Costs**

- **Fixed Costs**
  - Land
  - Tractor and Equipment
  - Irrigation system

- **Variable Costs**
  - Pre-harvest
  - Post-harvest and Marketing

  - Land preparation
  - Inter-cultural operation
  - Packaging and handling
  - Storage
  - Brokerage

**Returns**

- **Price**
- **Quantity (Yield)**

- **Revenue**
- **Cost**

- **Net cash flow**
- **Net Present Value**

Discount rate: 2% and 5%
Deterministic budget: Data

- Primary and Secondary data
- Input recommendations & prices - UGA extension team & agricultural vendors
- Machinery & equipment costs - AAEA Task Force on Commodity Costs & Returns
- Yield/acre and price/lb. - multiple meetings and focused group discussion with growers, county agents and blueberry growers
Methodology

Stochastic budget: Data

- A survey questionnaire: email (Qualtrics survey) and personal meet
- Total of 40 responses: 35 from personal meet and 5 via Qualtrics survey
- Time-series blueberry price and yield data
- Monte Carlo simulation using triangular distribution
  - Minimum, maximum and the most-likely yield
  - Minimum, maximum and the most-likely price
Now

- Background
- Methodology
- **Results and Discussions**
- Summary and Conclusions
- Limitations
## Results and Discussions

### Deterministic budget

**Table: Net cash flows of growing blueberries in Georgia for 15 years, 2020**

<table>
<thead>
<tr>
<th>Year</th>
<th>Yield (lbs./acre)</th>
<th>Price ($/lb.)</th>
<th>Return ($/acre)</th>
<th>Total Cost ($/acre)</th>
<th>Net Cash Flow ($/acre)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>9,796.72</td>
<td>-9,796.72</td>
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<tr>
<td>2</td>
<td>1,615</td>
<td>3</td>
<td>4,845</td>
<td>6,859.77</td>
<td>-2,014.77</td>
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<td>3</td>
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<td>3</td>
<td>11,400</td>
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<td>-1.92</td>
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<td>4</td>
<td>6,650</td>
<td>3</td>
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<td>2,351.53</td>
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<td>17,598.47</td>
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<td>17,598.47</td>
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<td>8</td>
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<td>17,598.47</td>
<td>2,351.53</td>
</tr>
</tbody>
</table>

NPV at discount rate of 2% = $12,128.70/acre

NPV at discount rate of 5% = $7,187.17/acre

**Full production year**
### Stochastic Budget

Significant variation in the blueberry prices and yields among growers

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum yield</td>
<td>3,456.76</td>
<td>1,980.40</td>
<td>900.00</td>
<td>8,000.00</td>
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<tr>
<td>Most likely yield</td>
<td>6,459.46</td>
<td>2,514.90</td>
<td>2,000.00</td>
<td>12,000.00</td>
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<tr>
<td>Maximum yield</td>
<td>10,910.81</td>
<td>4,415.87</td>
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<td>20,000.00</td>
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<tr>
<td>Minimum price</td>
<td>1.42</td>
<td>0.98</td>
<td>0.20</td>
<td>4.00</td>
</tr>
<tr>
<td>Most likely price</td>
<td>2.39</td>
<td>1.25</td>
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<td>Maximum price</td>
<td>4.04</td>
<td>1.92</td>
<td>1.00</td>
<td>7.50</td>
</tr>
</tbody>
</table>

Note: Yield in lbs. per acre and price in dollars per lb.
Results and Discussions

Expected NPV@2%: -$8,157/acre  
Expected NPV@5%: -$9,174/acre  
Chance: 30.24%  
Chance: 23.85%
Results and Discussions

Comparison

Deterministic

Expected
NPV@2%: $12,128.70
NPV@5%: $7,187.17

248.70% at 2% discount rate

Stochastic

Expected
NPV@2%: -$8,157
NPV@5%: -$9,174

178.34% at 5% discount rate
Now

• Background
• Methodology
• Results and Discussions
• **Summary and Conclusions**
• Limitations
Summary and Conclusions

- Traditional assessment approach can underestimate and overestimate the real profitability scenario of farm crops.

- Better understanding of all the potential stochastic variables and proper definition of their distributions yield more accurate and precise estimates of the outcome variables.

- The approach used in this study can have pivotal outturn during the agricultural policy formation and analysis.

- Direct implication in an individual farmer’s field.
Now

• Background
• Methodology
• Results and Discussions
• Summary and Conclusions
• Limitations
Limitations

• No consideration of cost as a random variable

• Equally critical as output prices

• Considered price and yield show same distribution every year
Thank You

Questions and comments are welcome. skunwar2@illinois.edu
The Adoption of Drying Value-Added Technologies in the Specialty Crop Industry

Ariana Torres, Ph.D.
Assistant Professor
Purdue University
Consumers demand differentiated products

• Consumers have lost trust on commodified food production (Lusk and McCluskey, 2018)

• Increasing demand for values-based and place-based foods
  • A shift towards smaller and specialty-good manufacturing
  • Consumer food and beverage spending is stagnant
  • National food brands are integrating local labels (Thilmany et al., 2019)
  • Start-ups and artisan brands (O’Hara et al., 2020)

• Still, there is a sizable budget-conscious consumer (bifurcation of food supply chain)
  • High consolidation among food manufacturers and national brands
Values- and place-based food labels

- Labeling systems are getting better formulated across the agri-food supply chain
- **Origin**: local, state-specific, domestic
- **Production practices**: animal welfare, organic, chemical free
- **Nutrition and safety**: traceability, free-from `<dietary restriction>`
Value-added agriculture

- 33,523 farms sold over $4 billion in value-added products (2017 Census of Ag)

- Food manufacturing is the largest subsector in rural manufacturing (Lambert and McNamara, 2009)
  - Small local businesses tend to improve local economic, job, and community resilience growth (Rupasingha, 2017; Low and Brown, 2017)

- Supply of value-added foods is correlated with food entrepreneurship in local food systems (Low et al., 2020)
  - More convenient presentation of agricultural products

- Rural and small business development policies must be well informed (Lusk, 2017)
Horticulture BUSINESS

Components of food and beverage manufacturing:
Sales, value of shipments, or revenue by industry, 2018

Meat processing is the largest single component of food and beverage manufacturing, with 24 percent of shipments in 2018

Framework

• Push vs. Pull
  • Diversification strategy (push effect)
  • Response to local consumer demand (pull effect) (Low et al., 2020)

• Downstream diversification
  • Vertical diversification (add value)
  • Horizontal diversification (access markets)

• USDA Value-Added Producer Grant
  • $37 million up to 2020
  • Increase yield, reduce costs, enhance product quality, protect health and environment
  • Definition: change physical state, enhance value, physical differentiation
Goals

• Categorize specialty crop farmers adoption of drying value-added technologies
  • Considering drying
  • Currently drying
  • Stopped drying
  • Never dried

• Investigate the drivers and barriers of adopting drying value-added technologies
  • Solar drying
  • Electric drying
  • Freeze drying
  • Open-sun drying
Data & Methodology

• 2018 web-based survey of 580 farmers in 32 states

• Means comparisons across farmers categories

• Ordered probit

\[ y_i^* = X_i \beta + \varepsilon_i \]

\[ y_i = 0 \quad \text{if } y_i^* \leq 0 \]
\[ y_i = 1 \quad \text{if } 0 < y_i^* \leq \mu_1 \]
\[ y_i = 2 \quad \text{if } \mu_1 < y_i^* \]

\[ \Pr(Y_i = 1|X_i = x) = \phi(\beta_0 + \beta_1 farmer + \beta_2 farm + \beta_3 networks) \]
Female tend to dry specialty crops
Minority farmers tend to stop drying
Crop diversification is correlated with drying
Selling in local markets is correlated with drying
Farmers using food labels tend to dry
Networks tend to motivate drying
Need of financial assistance is higher for those drying
## Results

**Ordered probit**

<table>
<thead>
<tr>
<th></th>
<th>Never dried</th>
<th>Considering</th>
<th>Drying</th>
<th>Stopped</th>
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<tr>
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<td>0.98</td>
<td>-0.27</td>
<td>-0.42</td>
<td>-0.29</td>
</tr>
<tr>
<td>female</td>
<td>-2.92</td>
<td>0.79</td>
<td>1.26</td>
<td>0.87</td>
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<tr>
<td>nowhite</td>
<td>-15.11 *</td>
<td>4.10 *</td>
<td>6.51 *</td>
<td>4.50 *</td>
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<td>0.05</td>
<td>0.08</td>
<td>0.06</td>
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<td>-0.39</td>
<td>-0.27</td>
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<td>0.21 ***</td>
<td>0.34 ***</td>
<td>0.23 ***</td>
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• **Minority farmers** are more likely to dry and stop it

• **Horizontal diversification** can drive vertical diversification
  - Number of crops
  - Income from specialty crops

• **Labels** can help market value-added products

• Value-added is more common among **smaller operations**
  - Increase sales

• **Entrepreneurial networks** are major value-added incentives

• Barriers to dry are mainly perceived among those drying or stopped drying foods
Implications

• Networks are major drivers of adoption of value-added technologies among specialty crop farmers
  • Entrepreneurial farming ecosystems can pull farmers to add value, generate other sources of revenue, and off-season sales
  • Foster networks via events, demonstrations, tours

• In the presence of market bifurcation, adopting value-added technologies can help rural farmers access high-value markets
  • Increasing sales
  • Increasing labelling (marketing strategies)
  • Crop diversification
• Policies and incentives aiming to improve diversification of rural farms should look into
  • Market channels available for farmers
  • Size of operations
  • Diversification technologies available

• The fact that minority farmers are more likely to dry and stop drying tells us there is room for improvement on assuring long-term investments among farmers

• Cost and knowledge of food quality standards are important barriers to successfully add value to agricultural products
Thank you for your time

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