

UMass Amherst
The Commonwealth College

Freezing Produce for a New Market:
Sharing the lessons learned from
Determining New Market Channels for
Local Producers

*An Integrated Research-Extension Program
Targeted Toward Determining New Market
Channels for Local Producers*

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WEBINAR AGENDA

- Welcome & Introductions
- Project overview
- Production “walk through”
- Process implementation
- Establishing quality & safety programs & tools
- Cost/Return analysis & tools
- Consumer market research
- Next Steps & Open Q/A

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Introductions

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Project Team

UMASS

FPC

 Amanda Kinchla	 Dan Lass Resource Ec.	 Jill Fitzsimmons
 John Waite FPC Director	 Liz Buxton Operations Mgr.	 Kate Minnefe Business Devel.

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Project Overview

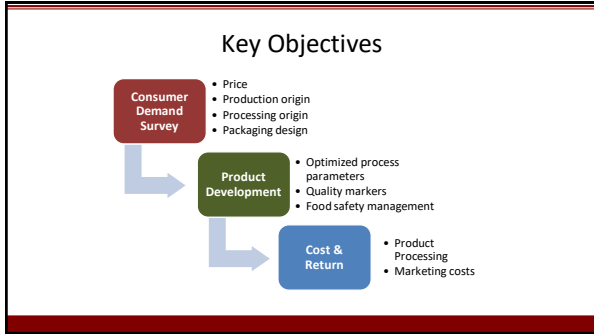
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Hypothesis

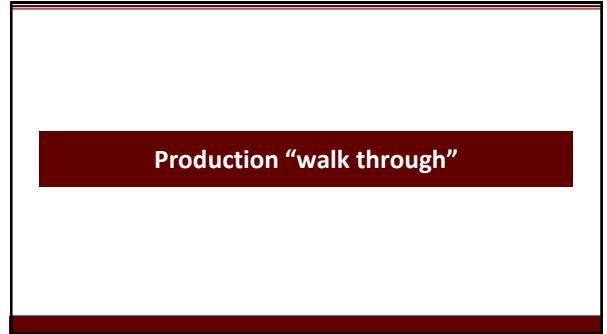
Local produce can be profitably grown and processed (frozen) for off-season retail sales.

- Consumers have higher *willingness-to-pay* for locally produced and processed frozen foods
- Costs of producing safe, high-quality locally grown and processed frozen foods will not exceed consumers’ willingness-to-pay.

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R&D

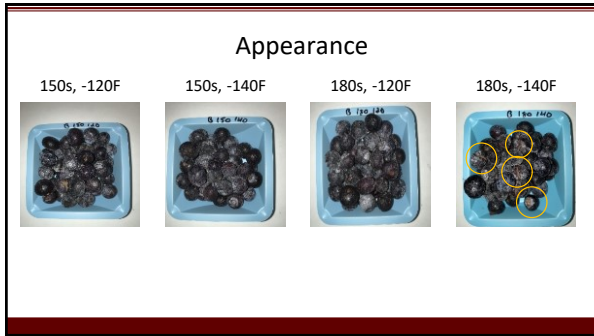
- **Activity:** Process Optimization
- **Method**
 - Bench top screening trials (washing, blanching, dwell time, temp)
 - Scale up at FPC
- **Result/ Outputs**
 - Non-proprietary SOPs for shared-use
 - Food safety plan
 - Process to support Obj 3 (cost & return)

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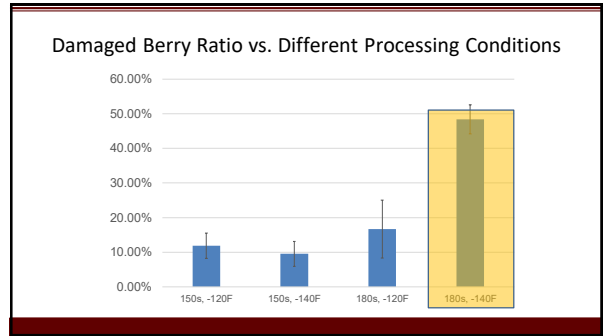
Blueberries Process Optimization

<p>Key Quality Attributes & Process Conditions</p> <ul style="list-style-type: none"> Texture Drip Loss 	<p>Analysis</p> <ul style="list-style-type: none"> • Variants: Temperature vs Time • Quality attributes: <ul style="list-style-type: none"> • Texture • Color • Polyphenols • Appearance • Drip Loss
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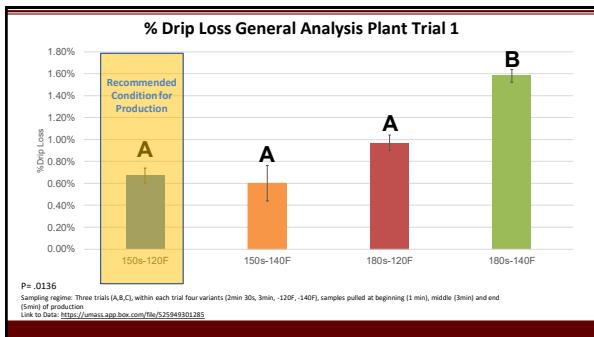
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Spinach Production Trials

- Three productions completed
 - 1) All loose-leaf spinach placed directly on belt -> significant fines
 - 2) compared loose- leaf vs. spinach “portions,” which were formed by pressing blanched spinach into patty mold
 - 3) All “portions”, different freezing conditions
- Yield on “portions” a bit higher than overall yield was very low (>50%)

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Process Optimization – Lessons Learned

- Developing optimal IQF processes depend on many factors, such as
 - Water content of product
 - Temperature of product before it is loaded into the liquid nitrogen freezing tunnel
 - Size and shape of product
 - Temperature of frozen storage
- With UMASS Food Science Department's assistance the WMFPC was able to determine more optimal process conditions based on drip loss and visual appearance
- Optimization of processes is important to find the "sweet spot" for obtaining a high-quality finished product while economizing the amount of liquid nitrogen used and having an efficient process.

At the beginning of WMFPCs IQF program, process parameters were determined by trial and error with only equilibrium temperature as a measurable outcome.

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R&D – Food Safety Plans

FS plan – IQF Blueberries

Implemented – July

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Components of a Food Safety Plan

- Recall plan
- Product/process description and flow diagram*
- Hazard analysis
- Preventive controls implemented
- Record keeping

*Not required, but highly recommended

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Hazard Analysis

(1) Ingredient/ Processing Step	(2) Identify potential food safety hazards introduced, controlled or enhanced at this step	(3) Do any potential food safety hazards require a preventive control?	(4) Justify your decision for column 3	(5) What preventive control measure(s) can be applied to significantly minimize or prevent the food safety hazard? (Process including CCPs, Allergens, Sanitation, Supply-chain, other preventive control)	(6) Is the preventive control applied at this step?	
		Yes No			Yes	No
Clean & Sort	B Vegetative Pathogen cross-contamination in water (Salmonella, Listeria and E. coli)	X	Cross-contamination in water could increase overall lot contamination	Process Preventive Control	X	
	C Sanitizer concentration too high	X	Not reasonably likely to occur with GMP			
	F Metal particles	X	Use of metal strainers are used to remove debris. However, not reasonably likely to occur with GMP-S.			

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R&D – Food Safety Plans

- Key Challenges
 - Validation for post-harvest washing
 - Implementing an Environmental Monitoring Plan (SOP)

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- ### FSP Lessons Learned
- For a FSP to be effective there has to be buy in from everyone in the system including the upper management
 - For the plan development and Hazard Analysis – assembling a team is necessary
 - Operators
 - Management
 - Food safety specialist who is familiar with the type of product and kind of facility
 - FSP is specific to the food, process & facility, they are not "plug and play"

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Food quality and safety tools


- Process Parameters (washing, drying, freezing, packing)
- Post FSP as a teaching exercise
- EMP protocol
- Quality assessment protocols
 - Drip loss
 - Visual quality

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Cost Analysis & Tools

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[Costs Estimation Tool](#)



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Production Costs

Cost per unit BLUEBERRIES is \$4.98/lb

- Fixed costs: \$0.49/lb
Include: equipment and overhead
- Variable costs: \$4.49/lb
Include: supplies, ingredients, wages

Cost per unit SPINACH is \$10.11/lb

- Fixed costs: \$1.71/lb
Include: equipment and overhead
- Variable costs: \$8.41/lb
Include: supplies, ingredients, wages



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Why the high costs?

High cost of fresh ingredients

- \$3.40 for spinach
- \$3.46 for blueberry

Equipment and Labor

- Equip. limitations
- Associated labor costs


Other challenges

- Blueberries in pints
- Leafy greens in IQF



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[Retail Cost Calculator](#)



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Consumer Market Research

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How Much Will Consumers Pay for Local/ Regional Frozen Products?

TAKE-AWAY: Different Marketing Approaches for Different Consumers

- “Local Foods” Consumers care most about where they buy frozen “local” products
- “Traditional” Consumers are more price-sensitive

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How Much Will Consumers Pay for Local/ Regional Frozen Products?

- What do consumers care about?
- Do they care enough to pay a price premium?
- Is the premium enough to:
 - ✓ Cover production costs?
 - ✓ Pay farmers a premium?

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What do consumers care about?

We tested the following product characteristics:

- Where the product is grown
- Where the product is frozen
- Where they buy it
- How much they pay
- What the package looks like

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Choose your preferred option :

Price \$7.50 Package  Grown in the USA Frozen in the USA Bought From Direct from Farmer (Farmers Market, Farm Share, Farm Stand)	Price \$3.75 Package  Grown in the Northeast Frozen Bought From Supermarket (Chain or independent that sells only food)	Price \$5.60 Package  Grown in the USA Frozen Bought From Supermarket (Chain or independent that sells only food)	None of these options
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Choose your preferred option :

PRICE →



Price \$7.50 Package  Grown in the USA Frozen in the USA Bought From Direct from Farmer (Farmers Market, Farm Share, Farm Stand)	Price \$3.75 Package  Grown in the Northeast Frozen Bought From Supermarket (Chain or independent that sells only food)
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5 Variations:
 \$3.75
 \$4.75
 \$5.60
 \$6.55
 \$7.50

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Choose your preferred option :



PACKAGE →

Price \$7.50 Package  Grown in the USA Frozen in the USA Bought From Direct from Farmer (Farmers Market, Farm Share, Farm Stand)	Price \$3.75 Package  Grown in the Northeast Frozen Bought From Supermarket (Chain or independent that sells only food)
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4 Variations
 -Clear Bag
 -White Bag
 -Printed Label
 -Sticker Label

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Choose your preferred option :



	Option 1	Option 2
Price	\$7.50	\$3.75
Package		
Grown	In the USA	In the Northeast
Frozen	In the USA	Frozen
Bought From	Direct from Farmer (Farmers Market, Farm Share, Farm Stand)	Supermarket (Chain or Independent that sells only food)

4 Variations:
 -Local
 -In the Northeast
 -In the USA
 -(no info)

GROWN →

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Choose your preferred option :



	Option 1	Option 2
Price	\$7.50	\$3.75
Package		
Grown	In the USA	In the Northeast
Frozen	In the USA	Frozen
Bought From	Direct from Farmer (Farmers Market, Farm Share, Farm Stand)	Supermarket (Chain or Independent that sells only food)

4 Variations:
 -Local
 -In the Northeast
 -In the USA
 -(no info)

FROZEN →

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Choose your preferred option :

	Option 1	Option 2
Price	\$7.50	\$3.75
Package		
Grown	In the USA	In the Northeast
Frozen	In the USA	Frozen
Bought From	Direct from Farmer (Farmers Market, Farm Share, Farm Stand)	Supermarket (Chain or Independent that sells only food)

4 Variations:
 -Direct from Farmer (Farmers Market, Farm Share, Farm Stand)
 -Supermarket (Chain or Independent that sells only food)
 -Super Store ("Big Box" store that offers large household goods)
 -Cooperative Grocer (Food Co-op)

BOUGHT →

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Returns from Product Sales:

How much will consumers pay for a frozen retail product?

Who took part in this experiment?

Two Consumer Groups

- "Traditional Consumer" – New England primary household shoppers
 - Purchased sample of 500 respondents
- "Local Foods Consumer"
 - Sent to 3 mailing lists of local foods consumers ~250 responses

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Costs & Returns Analysis

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Processing & Sales Costs:

How much does it cost a farmer to process and sell local frozen blueberries?

Processing Options

- Will you hire a facility to Co-Pack
- Will you invest in On-farm equipment to process

Retailing Options

- Will you sell direct to consumer
- Will you sell through a non-farm Retailer

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Returns from Product Sales:

What price can you charge in the market place?

1. What characteristics does the final product have?
2. What market are you aiming for?

RETURNS = PRICE x QUANTITY SOLD

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Profitability Calculator



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Next Steps

- Second market research trial – post COVID-19
- Open Access Materials -[Freezing Produce for Retail](#)
 - Operational support
 - Process Parameters (washing, drying, freezing, packing)
 - Post FSP as a teaching exercise
 - EMP protocol
 - Quality assessment protocols
 - Drip loss
 - Visual quality
 - Project knowledge sharing (market research data summary, production tool, food safety plan)
- Project Publications

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Questions & Discussion

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Program Evaluation

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Thank you

This project work is supported by
Northeast SARE.



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Photo Journal

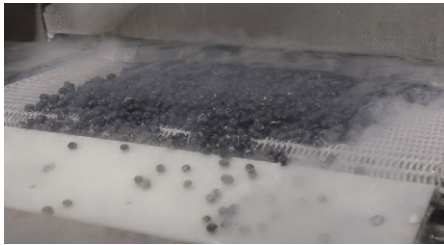
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Plant Trial: Investigating optimal process conditions



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Plant Trial: Investigating optimal process conditions



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Prototypes: Retail frozen blueberries



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Pulling quality assessment samples for R&D



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Spinach Washing



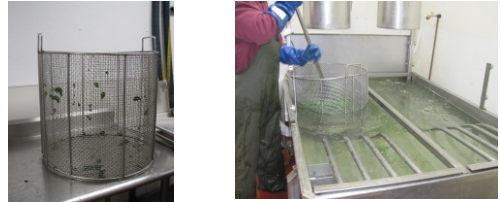
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Blanching & Cooling



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Blanching & Cooling



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Spinach Loading on the IQF Belt



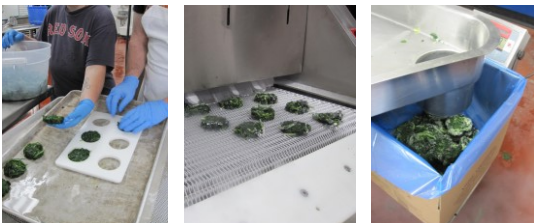
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Spinach Loading on the IQF Belt – “Free Form”



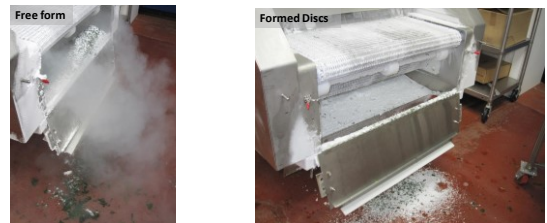
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Spinach Loading on the IQF Belt – “Formed”



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Product Fines in the IQF Undercarriage



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