

Tree Crop Food Safety Symposium

October 17 – 18, 2007

Summary

Outcomes

- Summary of individual breakouts
 - Summarize common research objectives that broadly impact treecrops/produce
 - Future meeting?
 - Technical committee to develop research grants at federal level
1. Evaluation of research objectives
 - Common goals
 2. Communication with policy regulators, retail, legislative
 - Short-term, Mid-term, Long-term
 - Small committee to determine hows/when/why/what; 30 days

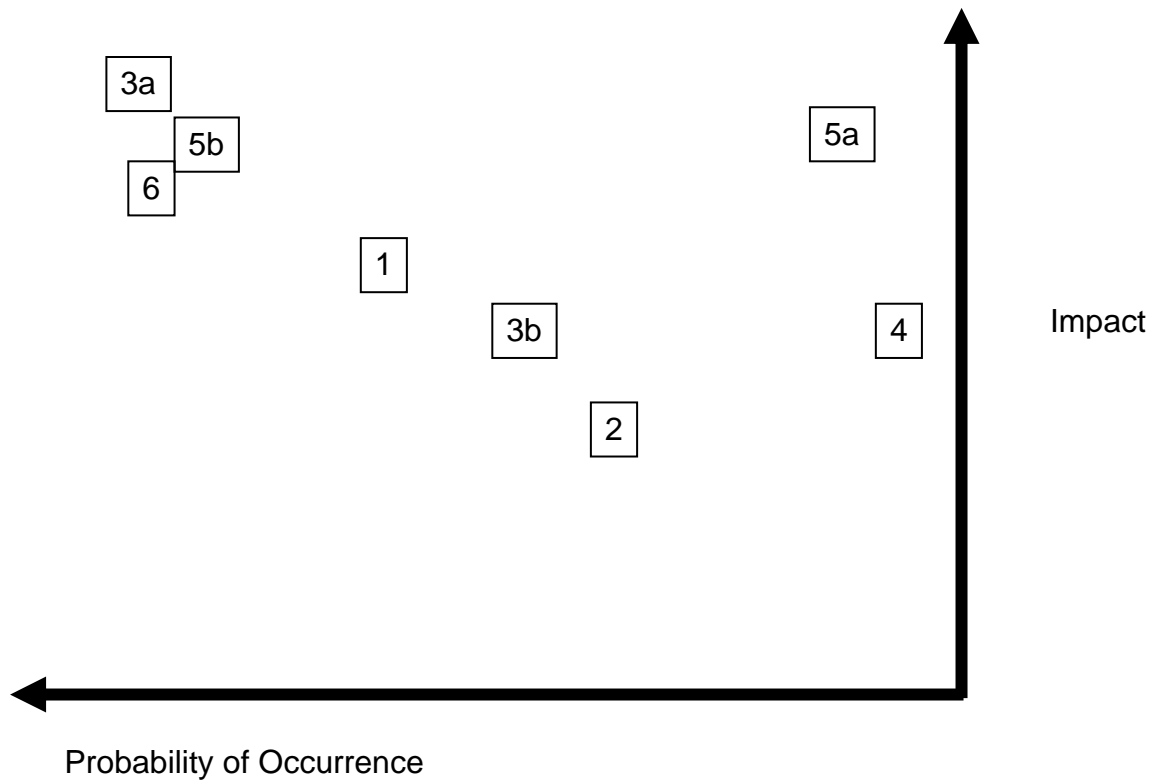


Figure 1. Probability of occurrence and impact of identified common research areas.

Common Research Areas (Figure 1)

1. Establishment of science-based water quality standards.
 - for foliar application, irrigation, processing
2. Unintentional water, weather, impact on orchard, on risk
3. Transference Mechanisms
 - How does transfer occur? Environment (3b) and Crop (3a)
 - Water
 - Air
 - Humans
 - Animals
 - Dust
 - Soil Amendments
 - Surfaces
4. Microbial Ecology of Orchard
5. Growth, persistence, survival, crop
 - A. Pre-harvest
 - B. Post-harvest
6. Methods to evaluate, validate, and verify post-harvest handling and processing steps that reduce risk.

BREAKOUT GROUP ONE: TREENUTS

Summary

1. Orchard Management – cover crops/replant fumigation (2 votes)
2. Orchard Sanitation (7 votes)
3. Soil Amendments (7 votes)
4. Water Quality/Management including rain and weather (7 votes)
5. Wild Animals
6. Damaged Fruit (4 votes)
7. Fumigation
8. Equipment Design (2 votes)
9. Education (1 vote)
10. Processed Product (6 votes)
11. Distribution

Orchard Management

- Cover crops; winter cover crops – no till
- Water – All same issues – not enough!
 - What is acceptable quality?
 - Foliar Spray
- Soil Amendments (dairy wastes for [almonds])
- Animals? Grazing?
- Weeder Geese?
- Orchard sanitation
- Soil Conditions
- Canopy
- UV light

Orchard Management Detail

Cover crops

- Winter Crops
- No till/till
 - Is it a risk?
 - Harborage?
 - Differences? In crop
 - Antimicrobial cover crop?

Soil Amendments

- Almonds/dairy lagoon/poultry litter
- Identification of critical factors – introduction from survival of pathogens
- Type/time/process

Animals

- Grazing
- Weeder geese

- Owls

Wild Animals

- Birds
- Squirrels
- Pigs
- Coyote

Tree Canopy/Pruning

- Sunlight
- UV penetration
- Soil moisture/temp
- Soil type

Orchard Sanitation

- Pre- and post-harvest
- Practices that up risks?
- No till, organic matter

Mummies (almonds)

Water Quality

- What is acceptable level of risk?
- Method of irrigation

Almond	Pecan	Walnut
At harvest <ul style="list-style-type: none"> • Varietal difference in exposure soft vs. hard shell • Dry hull • Dried in orchard 	At harvest <ul style="list-style-type: none"> • Varietal difference – shell • Hull split/sep on tree • Mechanical dry • Early pre-harvest drop 	At harvest <ul style="list-style-type: none"> • Varietal difference (hull split) • Wet hull removed • Wet • Mechanical dry • Early pre-harvest drop
Mechanical damage	Mechanical damage	Mechanical damage
Harvest from ground	Harvest from ground	Harvest from ground
Mechanically dropped and collected Time on ground 7-10 days	Mechanically dropped and collected <1 day ideal on ground before harvest	Mechanically dropped and collected <1 day ideal on ground before harvest
Weather <ul style="list-style-type: none"> • Dry 	Weather <ul style="list-style-type: none"> • Wet • Hurricane season impact 	Weather <ul style="list-style-type: none"> • Wet/dry
Stockpile		
Fumigation phostoxin		Fumigate methyl bromide

Almond has hull, dry in orchard remove dry= less than 6% moisture in kernel
Pecan no hull, mechanical drying; less than 4.5% moisture in kernel
Walnut has hull, wet hulling; mechanical drying 8% moisture in shell and kernel

Harvest Equipment/Totes

Walnut/almond
Peanut/pecan (discouraged)

Storage?, Clean?, Sanitize?

Post-harvest

Almonds wet – commercial dryer

Huller

- Almond dry H/S (loose kernels; dust spreads contamination, water)
- Walnut wet + 110 degree, 8 – 48 h, around 8% moisture
- Not Pecan
- Target moisture less than 8%, 6% typical

Dryer

- Pecans (hot air)
- Storage

Sheller

- Almonds – combined and hulling (majority)
- Walnuts – cracked
- Pecans
 - Sprayed
 - Soaked
 - Heated
 - Chlorine
 - Shelled (pieces vs. halves; separated and water/aspiration; edible vs. inedible)

Mechanical damage – does it increase risk?

Equipment design throughout post-harvest

- Clean/sanitize?
 1. Orchard Management
 - Cover crops/replant fumigation
 2. Orchard Sanitation
 3. Soil Amendments
 4. Water Quality/Management
 - Including rain/weather
 5. Wild animals
 6. Damage fruit
 7. Fumigation
 8. Equipment Design
 9. Education
 10. Processed product
 11. Distribution

BREAKOUT GROUP TWO: CITRUS

Pathogen of primary concern is *Salmonella*

Value Added/Retail/Food Service/Consumers

- Validation & verification of drying methods (165 – 168 degrees/24 hours)
- Safe-use of fresh-cut antioxidant solutions
- TTCS
 - Raw agricultural commodities
 - Fresh-cut

Fruit Handling (14 votes)

1. What are relative risk differences between wet and dry dumping. (2 votes)
2. What is the influence of wax application to overall risk
 - a. Survive and persist in wax
 - b. Survive and persistence on waxed fruit (1 vote)
3. What impact does grading have on reducing risk?
4. What is the impact of drying on risk?

Human Contact (11 votes)

1. What is the impact of employee hygiene and health?
2. What is the impact of employee contact on risk?

B. Transportation/Harvesting (15 votes)

1. What are the relative risks from different harvesting systems and factors that affect the risks?
2. What are the relative risks from different harvesting equipment and factors that affect the risks?
3. What role does employee hygiene play in harvesting risks?
4. What are the relative risks associated with the use of different types of bins and the stacking and cleaning of those bins?
5. Is there a significant risk associated with open air transport?

C. Packing House

Water (13 votes)

1. What is the persistence of pathogen in water with cleaner/sanitizer and potential mitigation steps?
2. What are appropriate water standards for packing house water and how should those standards be measured?
3. What is the impact of high pressure washes on pathogen contamination?

Food Contact Surfaces (conveyor, brushes, sponges, other equipment) (22 votes)

1. What are the transfer co-efficients of pathogens onto fruit, what are potential mitigation strategies?
2. What is the potential for mechanical abrasion influences on pathogen contamination?

Non-food Contact Environment (10 votes)

1. What influence does packing house design have on overall risk?
 - Air-flow
 - Cross-contamination from lights/catwalks
 - Wood use
 - Cleanability

D. Value Added (peel-on wedges and slices; peel-off wedges and slices)

1. How does pathogen survive/persist on fresh-cut citrus surface, do mitigation strategies exist to minimize the risks?
2. Does cross contamination between peel and fruit play a role in risk?
3. Influence of food contact surfaces on risk including transfer from cutting blade
4. Influence of human contact on risk

Canopy Management (8 votes)

1. How does canopy architecture influence, pathogen contamination and persistence?

Frost Control (0 votes)

1. How does frost control influence pathogen contamination and persistence?

Foliar Contact (9 votes)

1. What is survival of pathogen in foliar spray?
2. What is the transfer co-efficient of pathogen from foliar spray and what conditions affect it?
3. Persistence of pathogen following spray

Soil Amendments (12 votes)

1. What is the contaminating potential for soil amendments, their application practices, and tree architecture and what conditions affect it? Soil amendments = manure, compost, green waste

Pest control (15 votes)

1. Quantitative risk ranking of animals (vertebrate and invertebrate, domestic and feral) potential for pathogen contamination in orchards.
2. What level of intrusion leads to an unacceptable risk?

Site Selection (13 votes)

1. Microbial ecology due to prior land use
 - Include persistence of potential pathogen
2. Proximity to potential sources of contamination
 - How close?
 - What is distance?
 - What factors affect distance?
3. Proximity/likelihood of wildlife to site
 - Frequency of pathogen isolation

4. Plants – Variety specific, stony rootstock – mechanisms of transfer from sources to fruit (rank in order of importance)
 - Translocation –impact on risk
 - Attachment
 - Survival/persistence
 - Intrinsic and extrinsic factors are involved?

Irrigation (also for flood water) (26 votes)

1. What are appropriate water standards for citrus methods for monitoring standards?
2. What are transfer co-efficients and what are the conditions that affect it?
3. What is the persistence of pathogen on fruit from irrigation water and what factors affect it?

Distribution, Retail, Food Service, Consumer

Distribution (6 votes)

1. Does temperature control affect growth of pathogen and risk?
2. What is potential for cross-contamination? (truck, warehouse)

Retail/Food Service

1. What is impact of human contact (employee, consumer) on risk of contamination by bacterial and viral pathogens? (5 votes)
2. Impact of food contact surfaces? Value added at retail – cut and juice. (2 votes)
3. What is impact of co-mingling to contamination and traceability? (3 votes)
4. What is potential for cross-contamination from other food items, storage area, bins?
5. What is potential for lemon and lime wedges to contaminate beverages? (2 votes)

Consumer (8 votes)

1. What is contamination potential during hand peeling?
2. What is potential for cross-contamination?

BREAKOUT GROUP THREE: NON-CITRUS

Production & Harvest Non Citrus Crops

The effect of various cultural practices on the persistence and growth of human pathogens on different tree fruit crops in the orchard (e.g. spray interval). 8

Transfer coefficient of human pathogens to fruit via food contact surfaces including workers hands during harvest, thinning, etc. (8) What are effective intervention strategies, materials, etc.

Crop type (maturity, variety, environmental factors) effects on the growth and survival of human pathogens on the crop. (7/3)

Means to assess contamination risk by high risk adjacent land use (CAFO, etc). What variables are most important. How to reduce risks. (7/1)

How much risk does the presence of human pathogens represent in spray water and/or irrigation water. (7/1)

Human pathogen root to fruit uptake and contamination (wounded roots by soil amendment incorporation). (7/1)

Development of water microbial quality indicators (pathogens and non pathogenic indicators) that correlate with the presence or absence of human pathogens. (7/1)

Development and validation of surrogates for field trials. (6/0)

Postharvest Handling

Survival growth and persistence of human pathogens on food contact surfaces in postharvest packing house equipments, belts brushes. (7/2).

Optimizing management of re-circulated water used postharvest (flumes, drenches) 6/4
Processing aid incompatibilities with wash water disinfectants (pears).

Growth and survival of pathogens on fruit as affected by time, temp, RH, Pre-conditioning, packaging, CA/MA, treatments, waxing, 6/1

Optimizing efficacy of registered formulations and dose verification for pathogen reduction on fruit 6/0

Effect of waxing and edible coatings do they increase, decrease or have no effect on survival and growth of human pathogens (heat, etc).

Value Added

Validation and verification strategies to effectively evaluate drying methods.
Efficacy needed.

Safe use of fresh-cut antioxidant solutions

Time Temperature Control for Safety for fresh-cut

Consumer wash products.

Because outbreaks have not generally been associated with non-citrus fruits an initial research step would be to establish a risk profile (A Survey of Potential Risk)

Why

- Maximize use of customer demands for finished product testing.
- Provide a baseline measure of GAP/BMP efficacy.
- Identifies and targets limited food safety resources.
- Validates perception of low risk.

Microbes of Interest

- EHEC/ETEC
- *Salmonella*
- Generic *E. coli*

Testing & Sampling Harmonization

- Develop harmonized, standardized sampling and testing methods by commodity.
- Reduce potential for false positives & false negatives.

If positives are found, it allows one to determine and prioritize industry specific research needs by examining potential contributing factors:

- Seasonality
- Variety
- Growing Region
- Cultural Practices

Action Items

- Develop Harmonized Sampling and Testing Protocols (trade orgs and research community)
- Develop Blinded Reporting Mechanism (trade org or research institute)
- Develop rapid research response system to:
 - investigate positive finding,
 - identify contributing factors,
 - research to develop mitigation measures.