Microbial Food Safety for Produce : Details Make the Difference

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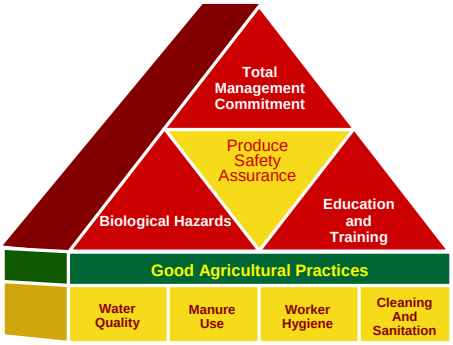
Ensuring produce safety requires a comprehensive and fully integrated system



Recent Outbreaks and Recalls Have Caused Major Changes in Attitudes and Approaches to the Safety of Fresh Produce

HACCP

Hazard **A**nalysis
and **C**ritical **C**ontrol **P**oint

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HACCP

- HACCP is a systematic approach to the identification, evaluation, and control of food safety hazards
- HACCP is not a zero-risk system
- It is designed to minimize the risk of food safety hazards
- Preventing problems from occurring is the paramount goal underlying any HACCP system

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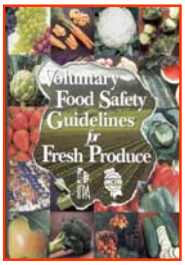
Key Barriers to Applying HACCP to Food Safety in Fresh Produce Systems

GAPs and GHPs ARE HACCP-based

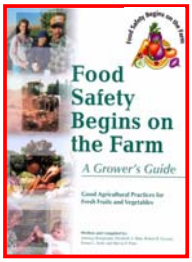
- Systematic and Comprehensive Analysis
- Hazard Identification & Analysis
- Written Procedures and Programs
- Written Responsibilities
- Training – Awareness and Process
- Verification
- Corrective Action & Re-evaluation
- Documentation & Record-Keeping
- Positive Lot Traceback System

Good Agricultural Practices: A Baseline Prerequisite for Food Safety On-farm and Beyond



1995

1998 (updated 2009)
IN DRAFT



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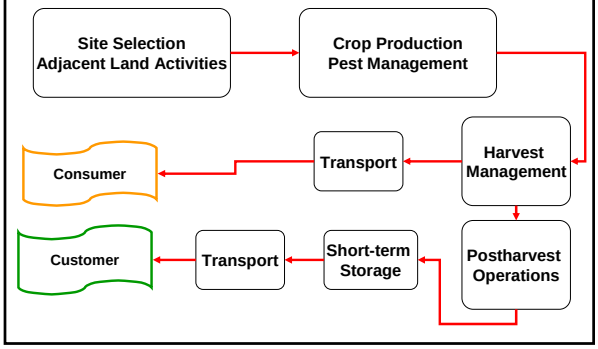
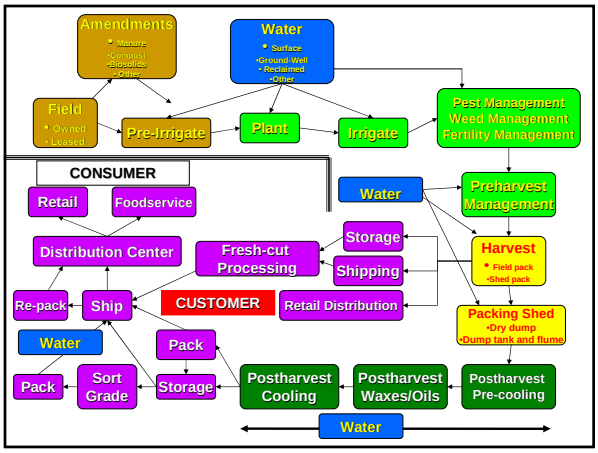
Typical GAP and GHP Training

- Overview of Produce Outbreaks
- Biology of Pathogens
- Food Safety Prerequisites
- Manure and Compost
- Soil survival and transfer
- Work Hygiene Training
- Preharvest Water
- Postharvest Water
- Cleaning and Sanitation
- Documents and Record-keeping
- Preparing for Audits
- Microbial Testing
- Pathogen Testing
- Test and Hold / Test to Release
- Traceability and Traceback
- Crisis Management Planning
- …….and more

Step 1:
Develop a Simple Process Flow Plan



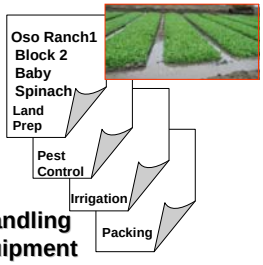
Step 2:
Add Site and Crop-Specific Details



Implementing GAPs
Step 3: Construct a Self-Audit of Potential Hazards

- Site selection
- Animal influences
- Fertility inputs
- Water inputs
- Irrigation
- Foliar sprays
- Harvest
- Human influences
- Worker hygiene
- Postharvest water and handling
- Sanitation – field and equipment

Record Keeping is Essential !



Essential Record-Keeping:
Prepare a Farm and Operations Map

- Parcel number and acreage
- Primary and secondary roads
- All ponds, creeks, seasonal water
- Wells; active and inactive
- All irrigation conveyances and lines
- All drainage and return-pump systems
- Subsurface tiles and conduits
- All buildings and seasonal structures
- …… and more

UNIVERSITY OF CALIFORNIA
Division of Agriculture and Natural Resources
http://anrcatalog.ucdavis.edu

In partnership with NRCS Natural Resources Conservation Service
http://www.nrcs.usda.gov

PUBLICATION 8062 FWQP REFERENCE SHEET 7.5

Reference:

Developing a Farm Map

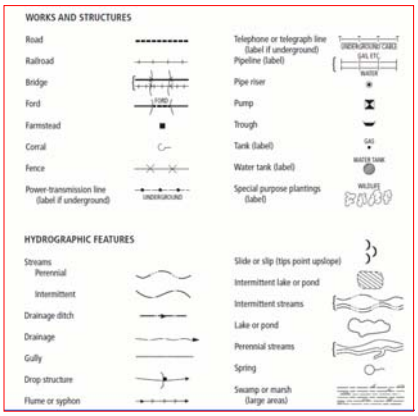
MERILARK PADGETT-JOHNSON is Viticulture Program Coordinator, Allan Hancock College, Santa Maria, California.

Maps play a useful role in the development and presentation of a farm plan. Much of the farm inventory can be shown on maps. Maps can graphically show the natural and cultural features present on the farm and their spatial relationships.

To develop a farm map, begin with a base map. Aerial, topographic, GIS, or even hand-drawn maps can serve as base maps. Aerial maps show features such as roads, fences, waterways, and vegetation. A common way to add information to a GIS base map is to add transparent layers that show additional features not shown on the base map. GIS is a computer system capable of assembling, storing, manipulating, and displaying geographical information in layers. Following is a list of farm inventory information that can be included in various maps and overlays:

BASE MAP

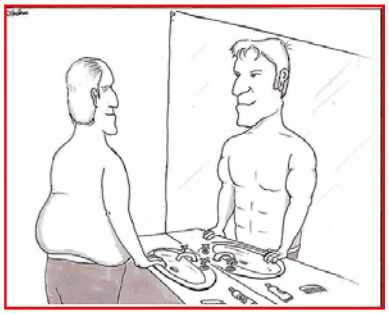
Begin by including an information block showing the name and location of the farm, names of the owner and manager, name of the person who developed the map, date of map preparation, and map scale.



Step 4: Conduct An Internal Audit

- ✓ **Conduct internal audits for each management and unit operation**
- ❖ **An internal audit should be done at start-up and at least once more in a season or within a 12 month period**
- ❖ **Define your own corrective actions**

An Honest Self-Appraisal is Critical



GAP Awareness and Self-Audit Resources

Good Agricultural Practices (GAP) for Growers: Quick Start Self-Audit

Section 1 Documentation

GAP Management	Exceeds Quick Start Target	Meets Quick Start Target	Get Moving Now!
1.1 Farm History & Physical Layout	Detailed and accessible records of land-use history and ownership available. Detailed maps of all production blocks include block and row numbers. Detailed layout maps of all facilities, including adjacent operations and land-use are maintained and updated annually. ☐	Records of land-use history and ownership are available. Maps of production blocks have reference numbers. ☑	Land ownership is documented. Maps of production blocks available but not detailed. ☐

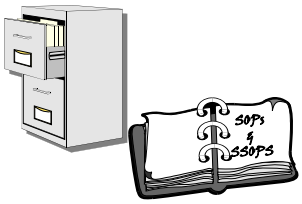
1.3 Management GAPs and Microbial Hazard Awareness	Ownership and operational managers have all received GAP training and certificates of GAP training are available for all supervisors. Evidence of periodic updated training is available. ☑	Documentation or certificates of GAP training are available for ownership and all supervisors. ☐	A copy a recognized GAPs guidance document is available. ☐

Example Self-Audit Outcome

Section 1 Documentation	Section 2 Employee Training	Section 3 Fertilizer and Soil Amendment Practices	Section 4 Water Quality and Source	Section 5 Orchard Floor	Section 6 Field Sanitation and Employee Hygiene	Section 7 Pest Control
1.1	2.1	3.1	4.1	5.1	6.1	7.1
1.2	2.2	3.2	4.2	5.2	6.2	
1.3	2.3	3.3	4.3	5.3		
1.4	2.4					
1.5	2.5					
	2.6					

Step 5: Keep Documents and Records

- organized
- accessible
- complete
- **use them to improve!**



It doesn't have to be fancy

Develop a Farm Operations Ledger: Lot, Preharvest, Harvest, Packing, and Shipping

- Handwritten is fine
- Can move to computer records
- Next step- handheld data recorders

Develop a Simple Lot Coding Program

- Grower, Ranch, Block
- Date of harvest
- Lot
- Harvest crew
- Date of packing
- Packing line
- Product Code
- etc.

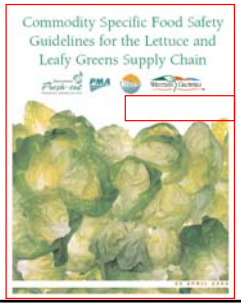
GW23C4209gt

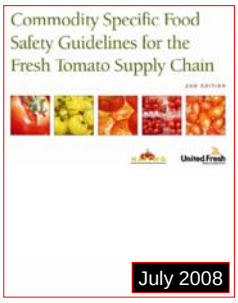
Grower | Ranch | Lot | Julian Date | Grape tomato

Approx. $26.00/stamp

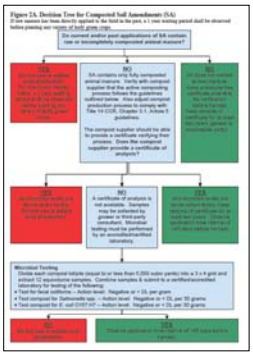
GAPs Now Incorporate More Specific "Metrics": Criteria for Compliance Audits

- **Quantifiable and verifiable criteria**
- **Improve public safety by applying uniform science-based standards**

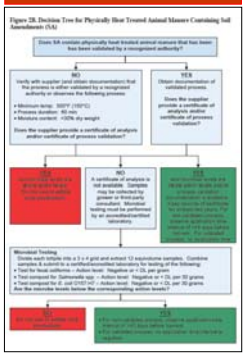




Decision-Tree: Composted Soil Amendments



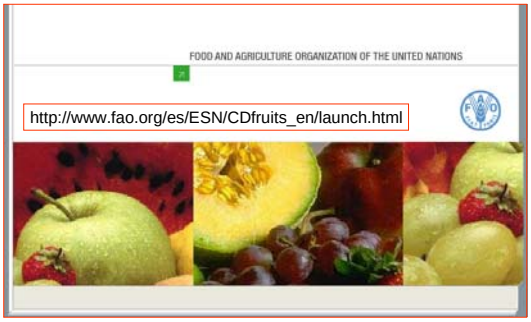
Decision-Tree: Heat treated Amendments With Animal Manure



FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS (FAO)

Food and Quality Standards Service
Food and Nutrition Division.
Viale delle Terme di Caracalla
Rome, Italy

http://www.fao.org/



Global Food Safety Initiative Seeks to Benchmark and Harmonize Food Safety Audit Criteria and 3rd-Party Audits

Recognized Certification Standards

- **British Retail Consortium**
- **International Food Standard**
- **Dutch HACCP**
- **SQF 1000 & 2000**

A Few Examples

Site Selection: Risk Exposure

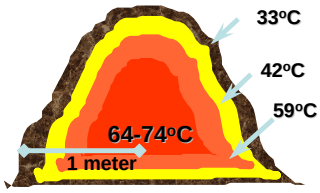
Current science cannot accurately predict the minimal pre-plant safety interval

Standards for Separation from Adjacent Land Activities are Highly Variable

- Sparse science-based data to set limits
  - Buyer requirements vary 30-ft to 1 mile
    - *depends on specific hazard*

Manure and Compost

Static piles develop a temperature gradient below thermal kill points



Measured at 1m
At least 55ºC (131ºF)
for 3 days
Non-regulated

Recontamination is possible

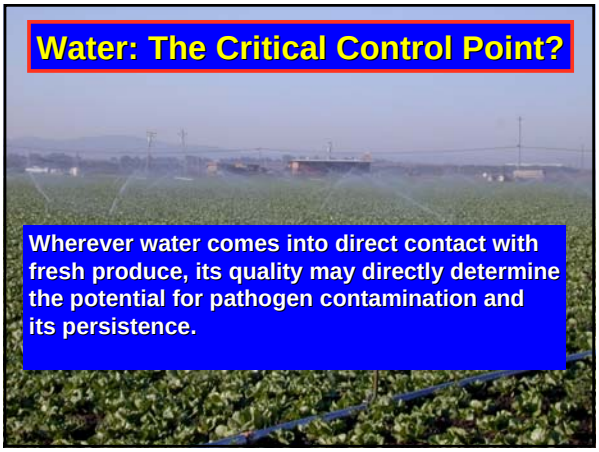
Expectations for Survival *Salmonella*

Soil	Manure	Other
Surface or incorporated – 300 days or longer?	**Feces** of carrier cows - 159 days **Slurry** 10 ºC 132 days 20 ºC 57 days 30 ºC 13 days	**Pasture** 91 to 231 days

Expectations for Survival *E. coli* O157:H7

Soil	Manure	Other
50 to 150 days (or more)	5 ºC - 70 days 22 ºC - 56 days 37 ºC - 49 days Slurry: 21 to > 70 days Feces: > 90 days	Water: 222 to 257 days *E. coli* O157:H7 found to persist for 120 days in water trough sediments Feed: *E. coli* O157:H7 has been shown to proliferate in moist feeds

Water: The Critical Control Point?



Wherever water comes into direct contact with fresh produce, its quality may directly determine the potential for pathogen contamination and its persistence.

Diverse Water Sources are Used

Concerns for Microbial Quality of Pre-harvest Water

Foliar Applications and Contact

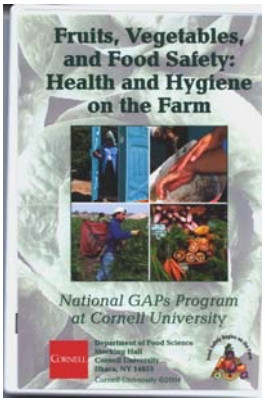
- Pesticides
- Nutrients
- Thinning aides
- Harvest aide
- Growth regulators
- Frost control
- Anti-transpirants
- Dust abatement
- Microenvironment management

Animal Intrusion

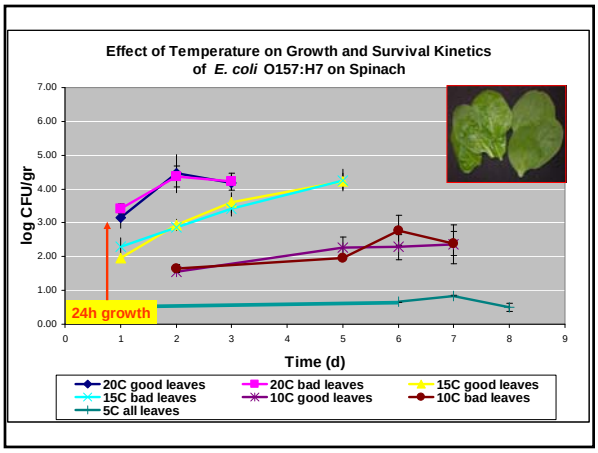
Significant Animal
• Cattle
• Pig
• Deer
• Goat
• Sheep

Non-Significant Animal
• Coyote
• Fox
• Dog
• Cat
• Horse
• Rabbit
• Raccoon
• Birds
• Chickens
• Reptiles
• Amphibians
• other

LGMA Standards recognize level of concern and required corrective action



Transportation and Distribution: Challenges to Cold Chain Control


Effect of Temperature on Growth and Survival Kinetics
of E. coli O157:H7 on Spinach
log CFU/gr
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
0
1
2
3
4
5
6
7
8
9
24h growth
Time (d)
20C good leaves
20C bad leaves
15C good leaves
15C bad leaves
10C good leaves
10C bad leaves
5C all leaves

Ice is the Forgotten Food

REVIEW

There are Multiple Nodes of Risk throughout the Chain

Describe your operation in detail

- ❖ All site characteristics
- ❖ All inputs
- ❖ All transfers to the end-user
- ❖ All seasonal influences
- ❖ Understand customer and consumer

Take home messages !!

#1 Food Safety Must be Planned From Seeding to Eating

#2 Details Make the Difference

#3 Food Safety Solutions Don't Have to be Complex or Expensive