GAPs
Good Agricultural Practices

Soil Amendments
Good Agricultural Practices

GAPs are the conditions, growing practices, and harvesting practices recommended for producing safe and wholesome fruits and vegetables.
Everyone has a stake and responsibility in reducing risk

- In fields, greenhouses, orchards
- During harvesting and transport
- During cleaning and packing
- In distribution and marketing
- In restaurants and food service facilities
- In the home
Good Agricultural Practices

GAPs aim to reduce risk of microbial contamination on the farm.

• Irrigation and wash water sources
• Soil Amendments
• Training about health and hygiene for people
• Farm and equipment sanitation
Soil Amendments

- Organic
- Inorganic
Soil Amendments

- A soil amendment refers to any material added to the soil to improve its physical and chemical properties.

- With fresh fruit and vegetables, food safety concerns are most often associated with biological contamination by pathogens in manure based soil amendments.
What Are the Potential Sources of On-Farm Contamination?

- Soil
- Irrigation Water
- Animal Manure
- Wild and Domestic Animals
- Inadequate Field Worker Hygiene
- Transport Containers (field to packing facility)
- Wash and Rinse Water
- Inadequate Processing Equipment Cleaning and Sanitation - equipment used to soak, pack, or cut produce
Wes Kline, From Rutgers NJ Agricultural Experiment Station
Review land history – Was it used for industrial dumping? Have animal waste or sludge/biosolids been applied? If yes, when?

- Ensure fields are upstream and upwind from animal containments. Identify upstream uses of surface water and test microbiological quality as needed.

- Ensure that contaminated water or livestock waste cannot enter a field via runoff or drift.

- Contact a local Cooperative Extension Service or Natural Resource Conservation Service representative to develop a detailed farm environmental management plan.
Site Selection

- Has the site been exposed to activities or conditions in the past that might have resulted in contamination?

- Is adjacent land being used for purposes that might result in contamination of crop land?
Site Selection

- Soil can be tested for fecal bacteria, heavy metals or chemical contamination.

- Fecal coliforms of E. coli are often used as indicators of contamination by manure or sewage.
Site Selection Summary

Select land for fruit and vegetable crops based on the land history, previous manure applications, and crop rotation. Keep produce fields away from animal housing, pastures, or barnyards. Study water movements on land to make sure that livestock waste from nearby barnyards cannot enter produce fields via runoff or drift.
Animal Feces

- **Domestic Animals**: Must be excluded from fields during growing season.

- **Livestock On Adjacent Land**: Must implement appropriate buffer zones and physical barriers to reduce the potential for contamination from animal feces on surrounding lands.

- **Wildlife**: Must monitor wildlife activity and where high concentrations of activity appear to increase risk of microbial contamination, take appropriate steps to address the risk in light of local, state, and federal laws and regulations.
Good Agricultural Practices for Manure Management

Three Types of Manure:

- Actively Treated
- Passively Treated
- Untreated

Different Rules and Requirements for Each.
Manure
Categorizing Risks

Highest Risk to Lowest Risk:

- **Fresh or Raw Manure** – manure that has not been aged or composted.
- **Aged Manure** – manure that has aged for at least 6 months prior to application.
- **Composted Manure** – manure that has been properly composted.
Compost Maturity (LDEQ)

- **Fresh Organic Matter**—raw material before undergoing decomposition (or at beginning of process).

- **Fresh Compost**—organic matter that has been through the thermophilic stage and has undergone partial decomposition.

- **Semimature Compost**—compost material that is at the mesophilic stage.
**Compost Maturity**

- **Mature Compost**—a highly stabilized product that results from exposing compost to a prolonged period of humidification and mineralization, beyond the stage of maturity. *Mature compost* shall have been cured for at least 60 days after the mesophilic stage is complete. Minimum starting moisture content for curing semimature compost shall be above 45 percent (by weight) and shall be raised to this value if necessary.
Three Phases of a Compost

1. Mesophilic phase (temps lower than 45C (113F), with *Bacillus mesophilos* & *Bacillus subtilis*)
2. Thermophilic phase (temps btw. 45-70C (113-158F) with *Actinomyces thermophilus*, *Bacillus thermophilus* & *levaduras*)
3. Maturation phase
Manure

Actively Treated Manure

Active Treatments generally involve a greater level of intentional management and a greater input of resources compared with passive treatments.
Manure

Actively Treated Manure

Active Treatments Include:

- pasteurization, heat drying, anaerobic digestion, alkali stabilization, aerobic digestion, or composting.
- Microstart 60 and similar fertilizers containing manure usually are heat treated and qualify as actively treated.
- Compost (Produced on Farm or Purchased Usually Qualifies.)
Composted Manure

- Composting guidelines often based on federal biosolids law (40CFR503):
  - **Within vessel or static aerated pile**
    - At or above 131°F for at least 3 days
  - **Windrow**
    - At or above 131°F for at least 15 days
    - Turned at least five times
Properly Composting Manure

- 33°C
- 42°C
- 59°C
- 64-74°C
- 1 meter
Manure
Actively Treated Manure

➢ Cure compost
  ▪ Leave finished compost in an undisturbed pile for at least 45 days.

➢ Remember
  ▪ Keep curing or finished compost away from ‘active’ compost piles.

**Best practice: store, cover or apply finished compost immediately following curing stage.**
Composted Manure

➢ Once compost is finished
  ▪ protect it from contamination.
Composted Manure

- Once compost is finished
  - protect it from contamination.
Manure

Actively Treated Manure

Rule for Actively Treated Manure and Products:

- Composted manure can be used on fields with a 0-45 day interval between application and harvest, depending on the crop being grown and the composting process.
Manure

Passively Treated Manure Products

- Passively Treated Manure Products Include Aged and Decomposed Manure
Manure

Passively Treated Manure Products

- Better alternative than using fresh or raw manure.
- Age for at least 6 months.
- Pathogens reduced, but still could be present.

*Avoid growing root and leafy crops in the year that manure is applied to a field*
Manure
Passively Treated Manure Products

Rules for Application of Passively Treated Manure:

- No applications less than 120 days for foliar applications AND applications for crops whose edible portion have contact with the soil.

- No applications less than 90 days before harvest for crops whose edible portions DO NOT have contact with the soil.
Composted Manure

- If compost isn’t produced in a satisfactory way
  - precautions similar to those for raw manure should be used.
- Know the source and treatment
  - Concern about compost is related to animal materials.
U.S. Composting Council
Seal of Testing Assurance
http://compostingcouncil.org/

 Seal of Testing Assurance (STA)

If it isn’t STA compost what is it?

The question posed above may, at first glance, appear to be a bit silly. However, if you are seriously thinking about making compost, specifying compost or purchasing compost, you want to know exactly what you are purchasing. The US Composting Council’s Seal of Testing Assurance Program (STA) is a compost testing, labeling and information disclosure program designed to give you the information you need to get the maximum benefit from the use of compost.

The program was created in 2000 and is the consensus of many of the leading compost research scientists in the United States. There was no other compost testing program available to compost producers or compost buyers that give you this type of information.

The science behind the development of the STA Program and the various tests that are used is contained in “Test Methods for the Examination of Composting & Compost” (TMECC). This publication includes a suite of physical, chemical and...
Manure

Untreated Manure Products

- Includes Raw Manure, Fresh Manure, and Manure that Has Not Been Adequately Aged and Decomposed.
Manure

Untreated Manure Products

Rule for Untreated Manure:

If untreated manure is used it shall be applied and incorporated into the soil prior to planting of crops or, for perennial crops, at the beginning of the growing season.
Sources Differ in Restrictions For the Use of Raw Manure

- LGMA requires 1 year
- NOP requires 90/120 days
- FSMA has proposed 4 months
Applying Raw Manure

- Avoid contaminating irrigation water, crops, finished compost or other materials with raw manure.

- What crop is in the next field?
  - Don’t apply manure or manure-containing litter while edible part of crop is present.
Manure and Compost Teas

Leachates and teas are used as foliar fertilizers and soil amendments to suppress pests and diseases, and enhance soil biology. Compost leachate is the liquid coming out of compost when water from irrigation, rain, or snow filters through the compost. Compost tea is made from compost steeped in water. There are two basic types of compost tea, aerated and nonaerated.
Types of Compost Teas

- Aerated tea = manure/compost mixed with water (1:10-50) and then aerated by injection or re-circulated water for 12–24 hours.

- Non-aerated tea = manure/compost mixed with water (1:3-10) and left untouched for several days (1–3 weeks).
To reduce the risk of pathogen contamination of produce:

Use potable water when mixing compost teas. The proposed FSMA produce rule requires any tea be mixed with water that is free of generic *E. coli* determined through testing.
To reduce the risk of pathogen contamination of produce:

Use properly composted manure. There is no application restriction on using compost tea made from properly composted manure (without additives), though it should only contact the soil and not the edible portion of the crop.
To reduce the risk of pathogen contamination of produce:

- Raw manure teas can only be applied to soil and not directly to plants, and should follow the one-year harvest interval. Additives (molasses, yeast, etc.) must follow the same one-year application to harvest interval as raw manure.
To reduce the risk of pathogen contamination of produce:

Compost leachate may be applied to the soil with the 90/120 day rule. It may NOT be applied directly to plant. Teas may NOT be applied to edible seed sprouts.
Manure Application Summary

- Do not assume any manure is ‘clean’.
- Incorporate, Incorporate, Incorporate
- Absolutely NO SIDEDRESSING with fresh manure.
- Know manure source and how it was handled
Incorporate Manure Into the Soil

- If the 120-day waiting period is not feasible, such as for short season crops like lettuce or leafy greens, apply only properly composted manure.
Choose Appropriate Crops

- Avoid growing root and leafy crops in the year that manure is applied to a field.

- Apply manure to grain or forage crops.

- Apply manure to perennial crops in the planting year only. The long period between application and harvest will reduce the risks.
Other Crop Management Practices to Decrease Contact with Manure

- Use trellis/staking where appropriate, such as tomatoes.
- Use plastic mulch and drip irrigation to reduce leaf wetting.
- Use organic mulches to reduce splash.
Manure Handling of Manure and Manure Products

Manure Storage and Treatment Sites:

- Furthest Practical Distance from Fields
- Adequate Practices and Physical Barriers to Prevent Contamination from Run Off, Leaching, Wind
Manure Handling of Manure and Manure Products

- Practices and barriers to prevent contamination of treated manure by animals or equipment use.

- Best Practice is to Cover All Manure stored on farm.
Louisiana Manure Storage

- Storage in an approved manure storage structures
- Raw manure storage areas near surface water can result in water contamination, either by run-off or through leaching. Safe distance recommendations from the surface water source depend on soil type and slope of land.
  - The Leafy Greens Marketing Agreement (LGMA) recommends at least 100 feet if soil is sandy, 200 feet if soil is clay or loam, and 300 feet if slope is greater than 6%. 

Consider the source, storage, and type of manure being used on the farm

- Store manure as far away as practical from areas where fresh produce is grown and handled. If manure is not composted, age the manure to be applied to produce fields for at least six months prior to application.
Consider the source, storage, and type of manure being used on the farm

- Where possible, erect physical barriers or wind barriers to prevent runoff and wind drift of manure.

- Store manure slurry for at least 60 days in the summer and 90 days in the winter before applying to fields.
The following general guidelines should be implemented in selecting a site and the construction of a litter storage facility:

- A 100-foot buffer strip should be maintained from wet areas, drainage ditches, streams, rivers, ponds, lakes or other surface water bodies.

- Permanent structures should have a base or floor of concrete or impermeable clay.
The following general guidelines should be implemented in selecting a site and the construction of a litter storage facility:

- Permanent structures should be designed in accordance with the USDA NRCS guidelines or the equivalent.

- Temporary storage should be covered with plastic or similar material to prevent runoff.
Upland buffer or incised stream or ditch channel with field erosion problem
All Manure Can Carry Pathogens

- Livestock
  - cattle, swine, poultry, horse, & sheep
- Dog and Cat
- Bird
- Rodent
- Deer
- Fly or other insect
- Human
Using Raw Manure

- Pathogen survival dependent on:
  - Type of pathogen
  - Rainfall
  - Soil moisture
  - Temperature
  - Soil type
  - Whether or not it is incorporated
Survival of Human Pathogens in Raw Manure

If the use of manure cannot be managed to prevent contamination or at least reduce the level of contamination risk to a negligible level, do not use raw manure on a food crop.
Plan Manure Application Timing Carefully

- Record keeping is important whether using raw manure or composted manure. For all soil amendment applications remember to document what, where, when, how, and how much was applied.
Keep Records of Manure and Compost Use

- Know your source of manure or compost.
- Know the methods used to produce compost or the manure storage time.
- Keep records of application rates, timing, and fields receiving manure or compost.
Manure
Records to be Maintained

Treated Manure Products:
- Documentation from Supplier for Purchased Products
- Compost Production Records for On Farm Compost
- Also Approval of Compost Procedure from OIA for On Farm Compost

Records for All Types of Manure:
- Application Records (Date and Field Where Applied.)
Required Records

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Summary

- Keep animals and run-off from their waste away from crops and irrigation water.
- Applying manure earlier and composting are ways to reduce risk.
- Take much caution if considering using fresh manure or compost tea.
Summary

- Biosolid production and use are regulated by federal and state law.
  - Pharmaceutical and heavy metal contamination are potential concerns.

- Consider what has historically happened on a field and what is currently going on around the site.
Traceback investigations reach far back to the source.