

Food Safety on the Farm: Good Agricultural Practices and Good Handling Practices—Manure and Municipal Biosolids¹

Keith R. Schneider, Renée M. Goodrich-Schneider, and Alexandra Chang²

As part of the Food Safety on the Farm series, a collection that reviews the generally recognized principles of GAPs as they relate to produce, primarily at the farm level and with particular focus on fresh Florida crops and practices, this publication focuses on GAPs and GHPs relating specifically to manure and municipal biosolids. The publications in this series can be found online at the EDIS website at http://edis.ifas.ufl.edu/topic_series_food_safety_on_the_farm.

Introduction

Good agricultural practices (GAPs) and good handling practices (GHPs) encompass the general procedures growers, packers, and processors of fresh fruits and vegetables should follow to ensure the safety of their product. GAPs usually deal with pre-harvest practices (i.e., in the field), while GHPs tend to cover post-harvest practices, including packing and shipping.

The use of manure and municipal biosolids as crop fertilizer is both safe and effective when properly administered. Pathogens may be introduced into the food supply, however, when contaminated forms of manure or biosolids—whether due to lack of treatment, improper treatment, or recontamination—contact produce. Produce in or near the soil is most susceptible to pathogenic contamination while crops in which the edible portion is kept away from

the ground yield a lesser risk for contamination. Growers using manure or biosolids should follow good agricultural practices in either scenario to minimize risk as well as identify possible sources of unwanted fecal matter in their specific growing environment.

Microbial Hazards

Both animal manure and human fecal matter provide a substantial source for pathogenic bacteria, namely the dangerous *Escherichia coli* O157:H7. *Salmonella* and *Cryptosporidium* may also originate from this source, creating a need for close management of all types of biosolids and manures to prevent contamination. Even with careful supervision, however, unexpected contamination may arise from the following possible sources: nearby manure processing or storage areas; livestock, or poultry operations; a dense wildlife area adjacent to the growing and harvesting environment; nearby municipal wastewater or manure storage, treatment, or disposal areas.

How to Control Potential Hazards

Good agricultural practices play an integral role in the reduction of potential hazards and are imperative to the production of safe produce. With regard to the use of animal manure and biosolids as soil amendments, GAPs

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2. Keith R. Schneider, professor; Renée M. Goodrich-Schneider, professor; and Alexandra Chang, graduate student; Food Science and Human Nutrition Department, UF/IFAS Extension, Gainesville, FL 32611.

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generally aim to reduce pathogens as well as to produce the greatest amount of time between implementation of these principles and the actual harvest of the crops. The U.S. Food and Drug Administration has identified and outlined the following areas to monitor: municipal biosolids, manure management (including active and passive treatments to reduce pathogen levels as well as handling procedures for both treated and untreated manure), and animal feces.

Municipal Biosolids

Several sources are available that outline requirements for the use of municipal biosolids. The Environmental Protection Agency published a note in the Federal Register on July 18, 1991 that describes U.S. Policy for the beneficial use of biosolids on federal land (56 FR 33186). Furthermore, Title 40 of the Code of Federal Regulations, part 503 (40 CFR part 503) states the specific requirements for the use of biosolids, including surface disposal and incineration. This portion of the CFR outlines pathogen reduction or elimination for various types of biosolids such as minimum times between application and harvest. These specifications may be accessed through an electronic search available at http://www.access.gpo.gov/nara/cfr/waisidx_06/40cfr503_06.html. Additional state requirements may also be applicable.

For tomato growers in Florida, the Florida Department of Agriculture and Consumer Services authorized Tomato Good Agricultural Practices (T-GAPs) to be taken in effect July 1, 2008. These T-GAPs are regulated for the purpose of preventing or minimizing contamination of tomatoes in all steps of production. T-GAPs regarding manure and land use can be found in the Tomato Best Practices Manual at http://fvreports.freshfromflorida.com/5G_TomBPM.pdf.

In addition to microbial risk factors, other possible hazards should be acknowledged, such as organic solids and potentially hazardous heavy metals. Other resources for growers concerning the use of biosolids include the USDA's Natural Resources Conservation Service (NRCS) and the Cooperative State Research, Education, and Extension Service (CSREES).

Manure Management

Good Agricultural Practices have been set forth concerning proper handling of manure. These GAPs include processes designed for pathogen reduction. Furthermore, methods to minimize both direct and indirect contact between manure and produce have also been outlined.

Pathogen Reduction

Various treatment methods may be utilized to achieve pathogen reduction in both manure and other organic materials. Individual growers and suppliers should choose proper treatments to accommodate their personal resources. Generally, treatments are divided into two groups: passive treatments and active treatments.

Passive Treatments

Passive treatments usually depend on the passage of time coupled with environmental conditions. Examples include moisture fluctuations, natural ultraviolet radiation, and temperature shifts. It is important for the manure to be well-aged and decomposed before application to field crops. Furthermore, these passive aging treatments should not be confused with active treatments like composting.

Active Treatments

Active treatments are much more labor-intensive and involve processes such as pasteurization, heat drying, anaerobic digestion, alkali stabilization, and/or aerobic digestion. Composting is common and involves the digestion of organic materials through either aerobic or anaerobic microbial action. Under careful conditions, pathogen reduction may be achieved in days from the generated heat. Much research is still being conducted to determine specific durations and temperatures needed to eliminate or reduce various pathogens under different conditions. Seasonal and regional climatic factors, such as temperature and rainfall, also affect these requirements. Specific management of the process operations should be considerate of ongoing research efforts.

Handling and Application

The handling and application of both untreated and treated manure should be evaluated to identify possible sources of contamination. The following practices should be recognized.

SEPARATION OF MANURE STORAGE AND TREATMENT SITES FROM FRESH PRODUCE AREAS

The risk of microbial contamination increases when manure storage and treatment sites are situated close to packinghouses or fresh produce fields. The minimum distance between the two will depend on many factors such as slope of the land (for runoff), climate, and the quantity and containment of the manure.

PHYSICAL CONTAINMENT OF MANURE IN HIGH-RISK AREAS

Storage areas, in which heavy winds, runoff, and/or leaching are probable, should be properly secured with either barriers or physical containment. These may include concrete block, soil berms, pits, or lagoons. Storage on concrete slabs or clay-lined lagoons is recommended to minimize the possibility of leachate, or undesirable liquid runoff, entering groundwater systems.

MINIMIZATION OF LEACHATE CONTAMINATION

GAPs should be used to minimize the risk of leachate contaminating fresh produce. Since leachate forms from rainfall upon manure piles, growers may consider covering or sheltering these areas. Alternatively, growers may collect leachate for either controlled disposal or usage in moisture control (applicable during composting).

MINIMIZATION OF RECONTAMINATION POSSIBILITY

Since treated manure may be recontaminated by birds and rodents, manure should be stored away from harborage and/or covered to prevent microbial contamination. Moreover, equipment should be cleaned properly to prevent cross-contamination from partially-processed manure to produce fields. High pressure washes or steam sprays are appropriate before equipment enters produce fields.

Untreated Manure

Untreated manure poses a greater risk for microbial contamination than treated manure. The following GAPs should be considered:

- Incorporate untreated manure into soil prior to planting (to induce microbial competition).
- Do not apply untreated manure or leachate from manure to produce fields during the growing season prior to harvest.
- Maximize the time between application of manure and harvest of produce.
- Do not use untreated manure where the above GAPs are not possible, such as for fresh produce harvested throughout most of the year.

Treated Manure

Composted manure and other natural fertilizers should be used in manners which follow GAPs. Since the amount of processing needed to reduce or eliminate pathogens in

manure has not yet been determined for specific pathogens, recommendations similar for untreated manure are often implemented, especially the maximization of time between application and harvest. Additional GAPs for treated manure include the following.

- Avoid contamination of fresh produce by manure that is only partially processed.
- Apply GAPs that ensure all materials receive adequate treatment, such as thorough mixing to avoid cold spots.
- When purchasing manure, obtain a specification sheet from the supplier for each shipment. This sheet should outline treatment procedures.
- Contact state or local manure handling experts for advice explicit to growers' individual operations and climactic regions.

Animal Feces

Animal waste/fecal matter is a known source of foodborne pathogens. Although all animal contact cannot be excluded from outdoor farming and processing areas, farmers should implement GAPs to minimize the risk of animal feces contaminating fresh produce. GAPs for minimizing hazards from livestock are as follows:

- Do not allow domestic animals in fresh produce fields, vineyards, or orchards during the growing season.
- Take measures to prevent animal waste from adjacent fields or waste storage facilities from contaminating fresh produce. Fences, ditches, mounds, grass/sod waterways, diversion berms, and vegetative buffer areas may be used.
- Implement GAPs to deter or redirect wildlife from fresh produce crops.
- Monitor fields on a regular basis for wildlife incursion.

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