

# Assessing On-Farm Produce Safety Risks: Performing a Hazard Analysis

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## Overview

As consumption of fresh fruits and vegetables in the United States has increased, so have foodborne disease outbreaks and recalls associated with fresh produce (Callejón 2015; Painter 2013). In addition to compliance with regulations such as the Food Safety Modernization Act (FSMA) Produce Safety Rule, the marketplace has become stiffer in terms of on-farm produce safety requirements. Growers selling to larger buyer channels and institutions are often required to obtain Good Agricultural Practices (GAP) food safety certification. While growers selling through direct market channels including farmers markets and roadside stands do not typically need certification, they may have on-farm produce safety standards to achieve. Regardless of the market outlet channel and/or size of the farm, the potential for produce contamination exists. Thus, understanding on-farm produce safety risks is essential for all farms who grow, harvest, pack, hold and/or ship fruits and vegetables. The first step to developing and implementing best practices to reduce risks and reduce potential produce contamination is to perform a hazard analysis, where you identify risks that may be associated on your farm. This publication is the first in a series of seven factsheets to assist you in creating a food safety program (Figure 1).

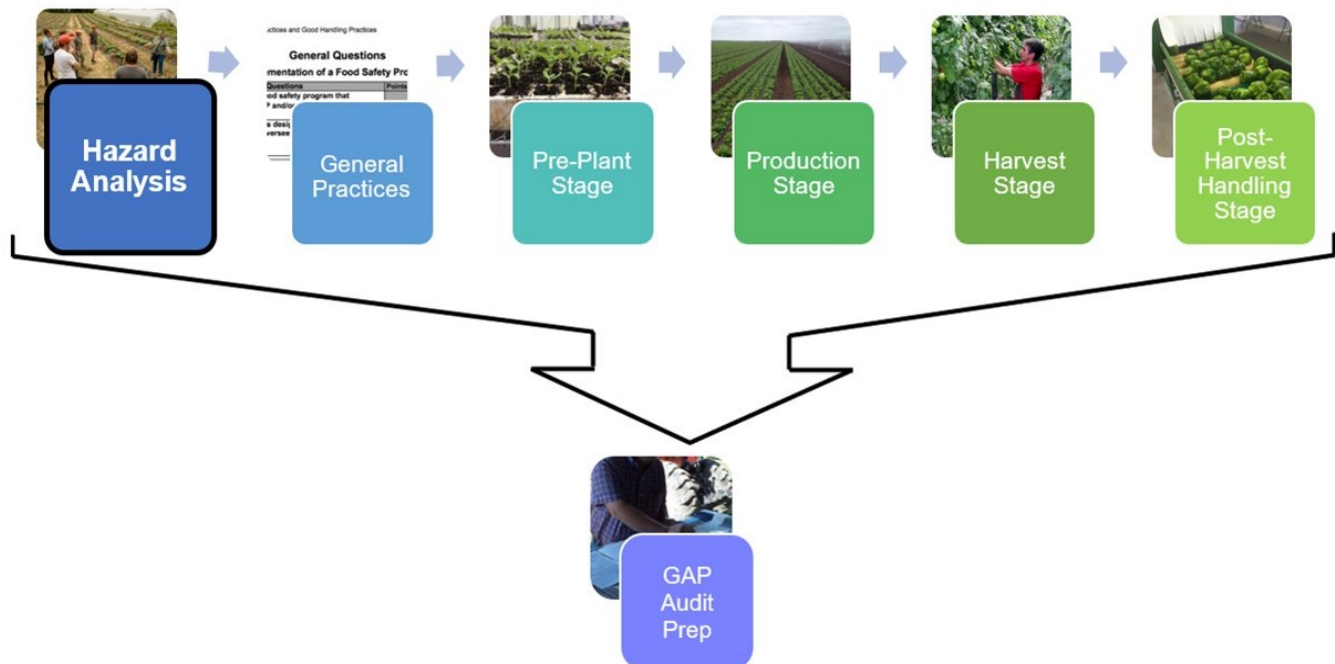


Figure 1. This series is designed to provide produce operators with the knowledge and tools to develop and implement Good Agricultural Practices (GAP). The final publication provides guidance for tying all the pieces together in preparation for a third-party food safety audit.

# Identifying Hazards On-Farm

There are three types of hazards: biological, chemical, and physical. Biological hazards include bacteria, viruses, parasites, yeasts, and molds that may cause foodborne illness. Chemical hazards include household cleaning products, sanitizers, lubricants, paints, petroleum products, bulk fertilizers, and pesticides. Physical hazards include organic debris, nails, screws, staples, metal, glass, wood, and plastic. While chemical and physical hazards need to be addressed on-farm, biological hazards pose the greatest concern because of pathogens. Human pathogens (biological hazard) are microorganisms that cause disease or illness in people. Understanding how fruits and vegetables may become contaminated (i.e. contamination routes) by these hazards is important to developing and implementing GAP. It is important to think about the routes of contamination in the context of the crop being grown and at what specific stage of the process; for example, pre-planting, production, harvest, and post-harvest handling. There are five primary ways hazards are spread on the farm:

- Humans (e.g., workers, visitors)
- Water (e.g., irrigation, spray applications, frost protection, post-harvest washing, ice)
- Animal-based Soil Amendments (e.g., manure, compost, compost teas)
- Animals (e.g., birds, deer, livestock, pets)
- Tools, Equipment, Vehicles, and Facilities (e.g., knives, containers, food-contact surfaces, packing lines)

One way to start identifying on-farm hazards is to draw a map of the different parts of the farming operation and consider the primary ways crops may be contaminated (Figure 2).

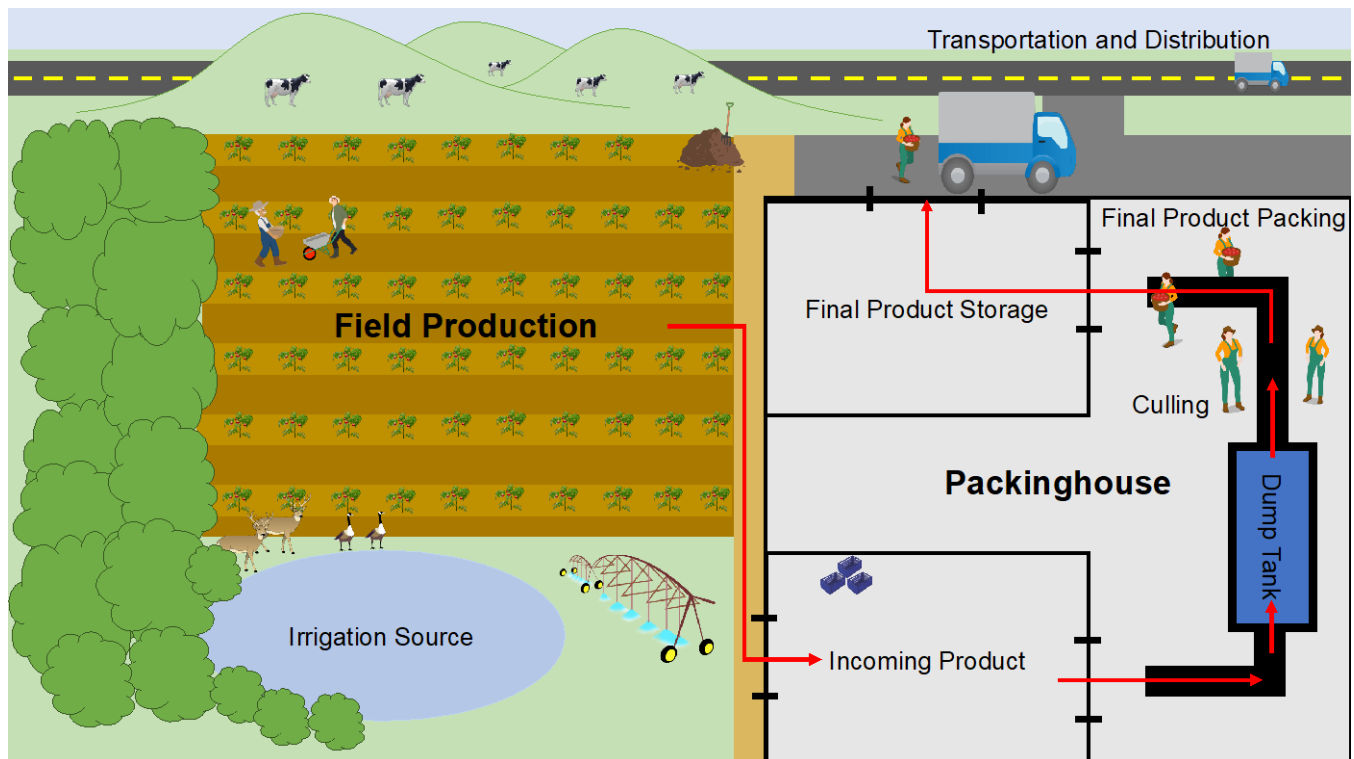


Figure 2. Example map showing the farm operations including fields, irrigation sources, adjacent land-use types, packinghouses, storage coolers, transportation and distribution, among other features. A map of the farming operations allows you to visualize hazards or potential contamination pathways for the different processes performed at each stage. For instance, crops grown in the field are located adjacent to a forest, where wildlife might pose a risk. An operator might want to think about if the fields are monitored for evidence of wildlife, such as animal tracks, droppings, trails, or damaged crops, as well as what measures might be implemented to exclude or deter wildlife from fields.

## Getting Started: Creating a Sketch of your Farm

To get oriented, first obtain an aerial map that shows the entire farm area with natural features and structures. Sources like Google Earth, Natural Resources Conservation Service (NRCS), Farm Service Agency (FSA), or county GIS maps can all provide a good starting point (see Resources). Print out the map(s) and then sketch the location of fields showing various areas of the operations including fields, high tunnels, greenhouses, irrigation sources, packinghouses, chemical storage buildings/areas, and roads. Then, to provide better details for packing areas, you can create additional close-up sketches. For instance, draw in packing tables, wash systems, coolers, handwashing sinks, bathrooms, break-areas, storage spaces for harvest tools, and other areas. Sketches do not need to be technical or elaborate. The goal is to have enough detail to identify ways produce can become contaminated by hazards and assist in implementing best practices (GAP) to control on-farm risks (Figure 3).

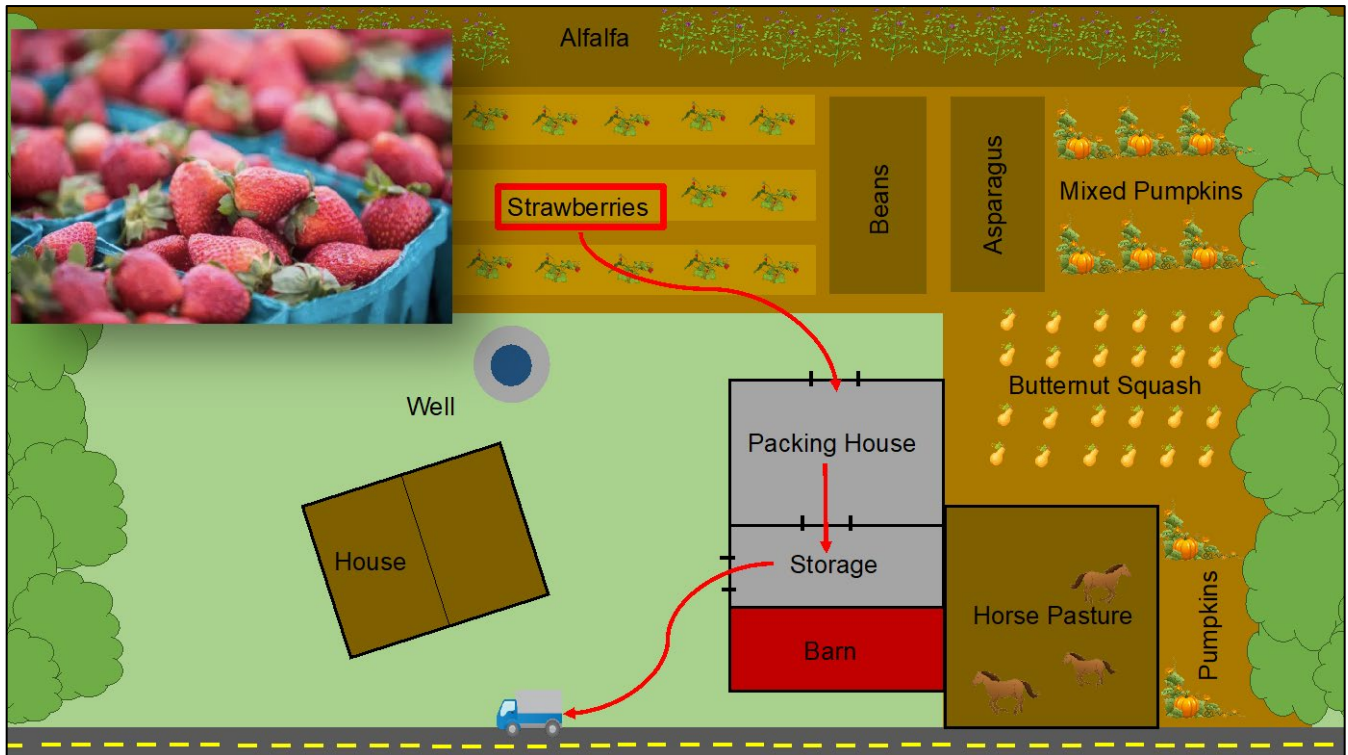


Figure 3. Example of a simple sketch showing the layout of a farm including fields and crops being grown, water sources, physical structures, livestock, and surrounding areas (such as bean and alfalfa fields, and a road). The red lines show the movement of the strawberry crop harvested from a field to the packinghouse area, then to a storage unit and transported by a refrigerated truck to a nearby produce auction market.

As you create your maps and sketches, you can also outline your entire process on a separate sheet of paper. If you grow multiple crops, you will need to consider pre-plant, production, harvest, and post-harvest handling practices for each crop, and how practices might or might not differ. You will use your maps, sketches, and outline to focus on three primary questions:

- What are the potential hazards (biological, chemical, physical) at each stage?
- What are the sources of contamination at each stage?
- What practices can be implemented at each stage to minimize hazards?

## Next Steps

As you dive deeper into the topics discussed subsequently in this factsheet series (General Questions, Pre-plant Stage, Production Stage, Harvest Stage, Post-harvest Handling Stage, and GAP Certification), you will find a series of questions at the end of each factsheet to get you thinking about your farm. These questions will ask about

risks at each stage and help you outline specific steps that you should complete. All of your maps, sketches, diagrams, any of your written notes, and answers to these questions can be used to help you develop your food safety plan or GAP manual. In the final factsheet of this series (Preparing for GAP Certification) we provide a step-by-step guide to assist you in the certification process. The guide discusses how to create your food safety plan (manual), identifies documents you will need, and lists on-farm practices to address any identified risks. A comprehensive pre-audit checklist is provided as a way to confirm you have addressed any “to-dos” prior to your actual food safety audit (Bardsley et al. 2021b, c; Vallotton et al. 2021a-c; Edwards et al. 2021).

## References

- Bardsley, C., A. Vallotton, A. Edwards, and L.K. Strawn. 2021b. Assessing On-Farm Food Safety Risks: General Practices. Virginia Cooperative Extension.
- Bardsley, C., A. Vallotton, A. Edwards, and L.K. Strawn. 2021c. Assessing On-Farm Food Safety Risks: Pre-Plant Stage. Virginia Cooperative Extension.
- Callejón, R. M., M.I. Rodríguez-Naranjo, C. Ubeda, R. Hornedo-Ortega, M.C. Garcia-Parrilla, and A.M. Troncoso. 2015. Reported Foodborne Outbreaks due to Fresh Produce in the United States and European Union: Trends and Causes. *Foodborne Pathogens and Disease*. 12, 32–38. doi:10.1089/fpd.2014.1821.
- Edwards, A., A. Vallotton, C. Bardsley, and L.K. Strawn. 2021. Assessing On-Farm Food Safety Risks: Preparing for GAP Certification. Virginia Cooperative Extension.
- Painter, J. A., R.M., Hoekstra, T. Ayers, R.V. Tauxe, C.R. Braden, F.J. Angulo, et al. 2013. Attribution of Foodborne Illnesses, Hospitalizations, and Deaths to Food Commodities by Using Outbreak Data, United States, 1998–2008. *Emerging Infectious Diseases*. 19, 407–415. doi:10.3201/eid1903.111866.
- Vallotton, A., Bardsley, C., A. Edwards, and L.K. Strawn. 2021a. Assessing On-Farm Food Safety Risks: Production Stage. Virginia Cooperative Extension.
- Vallotton, A., Bardsley, C., A. Edwards, and L.K. Strawn. 2021b. Assessing On-Farm Food Safety Risks: Harvest Stage. Virginia Cooperative Extension.
- Vallotton, A., Bardsley, C., A. Edwards, and L.K. Strawn. 2021c. Assessing On-Farm Food Safety Risks: Post-Harvest Handling Stage. Virginia Cooperative Extension.

## Additional Resources

[Google Earth](#).

[Web Soil Survey \(USDA NRCS\) website](#).

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