

Sprouts

Introduction

Sprouts are the germinated seeds of various herbaceous plants, including vegetables, herbs, and field crops. The entire germinated plant (root, shoot, cotyledons, and remnant seed coat) is sold for use mainly in salads and sandwiches. Sprouting is considered a form of food processing, rather than agricultural crop production; as such, it is regulated by the U.S. Food and Drug Administration (FDA).

At first glance, the quick turnaround time of sprout production may be very appealing to growers. However, producing sprouts is very labor-intensive and carries considerable risk. Recent food-borne disease outbreaks, traced back to contaminated sprouts, have caused sprout production to come under heavy scrutiny. As a result, it is expected that FDA regulations affecting sprout production practices, facilities, and marketing will become more stringent in the future. Meanwhile, the FDA, in cooperation with the Institute for Food Safety and Health within the Illinois Institute of Technology, has announced the establishment of the Sprouts Safety Alliance (SSA). The purpose of the SSA is to provide support to the industry by identifying and implementing the best practices for safe production of sprouts.

Following voluntary guidelines established by the sprout industry, FDA, and SSA for the safe production of sprouts will be critical to successful sprout production. It is the producer's responsibility to be fully aware of the risks involved and how to follow pertinent laws and regulations. Refer to the FDA publication *Guidance for Industry: Reducing Microbial Food Safety Hazards for Sprouted Seeds* for a summary of the risks and necessary precautions.



BEAN SPROUTS

Marketing

Sprouts can be marketed to the gourmet and health food market, as well as farmers markets, local grocers, and restaurants. Market outlets for a processed crop usually demand the processor deliver a continuous supply and quantity, especially to grocers and restaurants. Market outlets may also require sprout producers to adhere to even more stringent food safety standards. Consistent quantity, following food safety guidelines, and meeting product quality standards are all significant barriers for marketing sprouts.

Market Outlook

Sprouts are widely regarded as nutritious and are popular among health-conscious consumers. However, sprouts have been the source of several food-borne disease outbreaks in the U.S. The FDA considers sprouts a high risk food and has cautioned children, the elderly, and those with weakened immune systems against eating raw sprouts of any kind. In addition, some restaurant chains are pulling sprouts from their menu due to a loss of confidence in their sprout suppliers. Despite these problems and concerns, sprouts remain in demand. The market is now more diverse —

once dominated by alfalfa and bean sprouts, the market now includes other vegetable sprouts, such as adzuki beans, broccoli, peas, buckwheat, rye, and wheatgrass.

Production Considerations

Microbial contamination issues

The most common pathogens involved in food-borne diseases that have been traced back to sprouts are *Escherichia coli* (often simply referred to as *E. coli*) and *Salmonella* spp. In addition, some sprouts have tested positive for the potentially deadly *Listeria monocytogenes* pathogen. The likely source of these microorganisms is the contamination of seed prior to sprouting. Seeds are often produced without the knowledge that they are destined for the sprout market, thus precautions against contamination may not be taken. Contamination with the bacteria that cause foodborne disease can occur when seeds for sprout production come into contact with animal waste during production, harvest, transportation to the sprouting facility, or in storage. Raw manure applied to the field, grazing animals, and irrigation water are some of the possible sources of contamination during seed production.

Although bacterial levels present on the seed are generally very low and sporadic, the sprouting process provides such an ideal environment for the bacteria that they quickly multiply and contaminate the entire batch of sprouts. Bean sprouts, as well as other sprouts used in stir fry recipes, are less of a problem since they are cooked prior to consumption.

Obtaining, storing, and treating seed

Sprout producers should purchase seed that is free of pesticide seed treatments and grown using Good Agricultural Practices (GAP). Certified organic growers **must** use certified organic seed for edible sprouts production. The FDA also recommends seeds be obtained only from suppliers with a good program for screening their product for potential contamination. Purchased seed bags should be examined for evidence of water damage and animal droppings; a black light can be used to detect evidence of animal urine contamination on bags. Seed should only be stored off the ground in a dry, rodent/bird/insect-free facility.

To reduce the threat of sprouts harboring human pathogenic bacteria, sprout producers should treat

seeds with calcium hypochlorite prior to processing. This is deemed a more effect means of reducing contamination than attempting to treat the already germinated sprouts. While seed treatments have been shown to reduce bacterial contamination, the process is not 100% foolproof in eliminating harmful bacteria. Other techniques of decontamination, such as irradiating the germinated sprouts, are being researched, but these methods would require FDA approval before implementation by producers.

Crop selection

Seed from numerous herbaceous annuals and perennials can be used in sprout production. The most common are alfalfa and bean sprouts. Bean sprouts are generally produced from mung bean seeds, although other small-seeded beans (such as adzuki, navy, pinto, and soybean) have also been used. Sprout vegetable crops include arugula, broccoli, cabbage, garlic, onions, peas, pumpkin, and radish. Other potential seed crops include dill, sesame, and sunflower. Wheatgrass is produced from various cereals, such as wheat, rye, and triticale. Consumer demand for an assortment of flavors (e.g. spicy to mild) as well as textures and colors, will determine what growers need to grow.

Facilities and processing

Sprouts are produced by placing seeds in a warm, moist environment until they have germinated to the desired size. Each seed crop will have its own temperature and soak time requirements, but many germinate in 3 to 7 days. Facilities for production need to be equipped so that air and water temperature can be controlled. Supplemental lights may be required for sprouts in which green color (chlorophyll) development is in demand; however, greening is not desirable for all sprouts. Because cleanliness during production and harvest is so critical, all equipment and production areas must be made of rust-proof materials that can be easily sanitized daily. Workers need to wear the same sanitary gloves and gowns worn over clothing that is required in food processing facilities.

The FDA requires that sprouting facilities implement a Hazard Analysis and Critical Control Point (HACCP) plan, which includes following Good Manufacturing Practices (GMPs). In addition, maintaining complete and accurate records is critical to being able to trace contaminated product back to its source. If food-borne illnesses do occur, the contamination must be

traceable to specific products, distributors, or farmers. This means that recalls can be specific, rather than general blanket programs. Recordkeeping also helps growers establish that they executed due diligence in their production in the unlikely event that an outbreak is traced to their facility.

The specific methods and equipment for sprout production vary from one facility to another. In general, each batch of seed is first treated with a fresh solution of calcium hypochlorite and then rinsed several times with water. This is followed by a presoak for up to an hour to ensure seeds obtain a uniform moisture content. The pre-soaked seeds are drained and placed in sprouting containers where they are periodically sprayed with fresh water with the spent irrigation water drained off. Only potable water is used throughout the sprouting process. Seeds can be germinated in trays or in rotary drums using either manual or automated systems. If greening is desirable, germinating seeds are exposed to light near the end of the sprouting process.

Testing the spent irrigation water is another important means of ensuring the safety of the sprouts. This water, which has flowed over the sprouts during production, is a good indicator of the types of microbes that are present on the actual sprouts. The water can be collected by qualified personnel at the sprouting facility; however, the actual water tests should be conducted by an independent laboratory. Water for testing is generally sampled approximately 48 hours into the growing period (beginning at pre-soak), but may be collected up to 48 hours before the crop is harvested. Sufficient time needs to be allowed so that testing results are returned prior to harvest. If the water tests positive for any human pathogenic bacteria, the entire batch of sprouts should be discarded.

Pest management

Decay bacteria, which develop rapidly during the moist conditions of sprouting, can be a major concern with pre- and post-germinated seeds. Prevention involves purchasing high quality seeds, seed treatment with calcium hypochlorite, following strict sanitation protocols during production, and proper storage of the harvested sprouts. Using chlorinated or ozonated irrigation water may also be helpful in reducing the incidence of seed decay.

Harvest and storage

Once sprouts have reached the desired size they are rinsed; in some cases, remnants of the seed coat are also rinsed off. Excess water is removed using a centrifuge or similar equipment. Sprouts are packaged for retail sales in clear clamshell containers. Immediate and continued refrigeration is essential for maintaining product quality from harvest to end-market.

Labor requirements

Labor hours will vary considerably based on size and automation of the sprout production system, but even small-scale sprout production is very labor-intensive. In addition to production labor, there are significant management hours required for designing the production facility to meet safety requirements, monitoring sprout production, and ensuring safe handling and delivery of the products.

Economic Considerations

Sprouts production is classified as a food processing enterprise; such ventures can require large capital expenses. Initial investments for sprout production include facility and equipment expenses. Production training or consulting fees may be a large expense for beginning growers wishing to maximize production and quality. Food safety-related expenses, such as the time spent developing a food safety plan and testing irrigation water used for sprouts production, are another substantial expense. Commercial sprouts production is highly automated, and small-scale production will require the grower to obtain premium prices for profitability. Product liability insurance is another expense that will be incurred by sprouts growers. Growers should consult with a financial professional or develop a detailed profit and loss projection based on their experience and desired scale before launching an enterprise with a greater potential for production risks.

Selected Resources

- Good Agricultural Practices (University of Kentucky, 2012)
<http://www.uky.edu/Ag/cdbrec/introsheets/gap.pdf>
- Food Safety Information Concerning Sprouts (FDA)
<http://www.fda.gov/Food/FoodborneIllnessContaminants/StoreServeSafeFood/078690.htm>

- Guidance for Industry: Reducing Microbial Food Safety Hazards for Sprouted Seeds (FDA, 1999) <http://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/ProducePlantProducts/ucm120244.htm>
- Hazard Analysis and Critical Control Point (HACCP) Principles and Application Guidelines (FDA, 1997) <http://www.fda.gov/Food/GuidanceRegulation/HACCP/ucm2006801.htm>
- International Sprout Growers Association <http://www.isga-sprouts.org/index.html>
- Safer Processing of Sprouts — Modules (videos) (California Department of Public Health, Food and Drug Branch and U.S. Food and Drug Administration Center for Food Safety and Applied Nutrition) *Note: scroll down the Web page to the 'Produce Food Safety' heading* <http://postharvest.ucdavis.edu/libraries/video/>
- Sprout-Associated Outbreaks – NOP & EU Regulations and US Food Safety (Organic Trade Association, 2011) <http://www.ota.com/organic/foodsafety/organicsprouts.html>
- Sprouts and Wheatgrass Production and Marketing (ATTRA, 1999) <https://attra.ncat.org/attra-pub/summaries/summary.php?pub=78>
- Sprout Production in California (University of California, 2002) <http://anrcatalog.ucdavis.edu/pdf/8060.pdf>
- Sprouts: What You Should Know (FDA) <http://www.foodsafety.gov/keep/types/fruits/sprouts.html>

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For additional information, contact your local [County Extension](#) agent