Food and Agriculture Organization of the United Nations

World Health Organization

Joint FAO/WHO Expert Meeting on Microbiological Risk Assessment (JEMRA) on the Prevention and Control of Microbiological Hazards in Fresh Fruits and Vegetables

Part 3: Sprouts
(Virtual meeting, 22, 23, 24, 29 and 30 November 2021)

SUMMARY AND CONCLUSIONS

Issued on 05 January 2022

The virtual JEMRA meeting on the Prevention and Control of Microbiological Hazards in Fresh Fruits and Vegetables was convened to provide scientific advice on the general principles and relevant measures for control of microbiological hazards in sprouts from the production of seeds for sprouting, to the production of sprouts and point-of-sale.

If conditions had permitted, this meeting would have been held at FAO headquarters in Rome, Italy. Because of the travel restrictions and lockdowns due to the COVID-19 pandemic in many countries, the joint FAO/WHO secretariat was unable to convene a physical meeting. Therefore, the meeting was held as a videoconference using a virtual online platform.

Dr Tong-Jen Fu served as Chairperson.

Dr Lawrence Goodridge served as Rapporteur.

This document summarizes the conclusions of the meeting on sprouts (Part 3) and is made available to facilitate the deliberations of the upcoming Codex Committee on Food Hygiene (CCFH). The full report will be published as part of the FAO and WHO Microbiological Risk Assessment (MRA) Series.

The meeting participants are listed in Annex 1 of this summary report.

More information on this work is available at:

http://www.fao.org/food-safety/en/

and

https://www.who.int/foodsafety/en/

1. Background and objective

In 2019, following a request from the CCFH, the Codex Alimentarius Committee (CAC) approved new work at its 42nd Session on the development of guidelines for the control of Shiga toxin-producing *Escherichia coli* (STEC) in leafy vegetables and in sprouts (FAO and WHO, 2018).

To support the work of CCFH and to update and expand the information available in MRA14 (FAO and WHO, 2008), FAO and WHO is convening a series of expert meetings on preventing and controlling microbiological hazards in fresh fruits and vegetables.

In September 2021, the JEMRA meeting on the Prevention and Control of Microbiological Hazards in Fresh Fruits and Vegetables reviewed relevant measures for control of microbiological hazards from primary production to point-of-sale in fresh, ready-to-eat, and minimally processed fruits and vegetables, including leafy vegetables (FAO and WHO, 2021).

The purpose of this meeting was to reconvene a subset of the Expert Committee to collect, review and discuss relevant measures for control of microbiological hazards in sprouts, from the production of seeds for sprouting, to the production of sprouts and point-of-sale.

A subsequent meeting of JEMRA on the Prevention and Control of Microbiological Hazards in Fresh Fruits and Vegetables is scheduled to be held in 2022 and will focus on other commodity-specific recommendations.

2. Scope and definitions

Sprouts have different food safety concerns from other fresh fruits and vegetables because the conditions under which sprouts are produced (time, temperature, water activity, pH, and nutrients) are ideal for food-borne pathogen growth. Outbreak investigations have indicated that food-borne pathogens found on sprouts most likely originate from the seeds but could also be caused by contaminated production environment.

This report covers prevention and control measures specific to the primary production and handling of seeds for sprouting, the production of sprouts, and hygienic practices applicable at retail and food services. Recommendations for proper record keeping and establishment of product traceability programs that facilitate the identification and investigation of contaminated seeds and sprouts in the event of illness outbreak or product recall are also included.

Microbiological hazards and control measures related to shoots, cress and microgreens where the seed is not kept in the final product will not be covered in this report. Home sprouting or consumer interventions (i.e. cooking) will not be covered either.

Definitions

Sprouts – Sprouted seeds or beans harvested when the cotyledons (or seed leaves) are still un- or under-developed and true leaves have not begun to emerge. They can be grown in water, soil or substrate and can be harvested with or without the root (cut sprouts).

Spent sprout irrigation water - Water that has been in contact with sprouts during the sprouting process.

3. Microbiological hazards in sprouts

Sprouts represent a unique food safety challenge because the conditions under which sprouts are produced are ideal for the growth of bacterial food-borne pathogens. For this reason, the Expert Committee identified pathogens of concern as bacterial food-borne pathogens, including: Shiga toxin-producing *Escherichia coli* (STEC); *Salmonella* spp.; and *Listeria monocytogenes*, and specifically focuses on interventions against bacterial food-borne pathogens. While seeds may be contaminated with viral or parasitic food-borne pathogens, those pathogens do not increase in numbers during sprout production and few viral or parasitic foodborne disease outbreaks have been attributed to sprouts.

4. Prevention and control measures for seed production and handling

When outbreaks have been linked to sprouts, seeds are typically identified as the source of contamination. Seeds can be produced for use as human food and animal feed and are generally treated as raw agricultural products. Controlling and/or reducing microbial contamination of seeds is difficult, given the diversity of growing and harvesting practices associated with seed production. Still, interventions aimed at reducing the risk from seed-borne contamination should focus on controlling contamination from animal and human activities; ensuring proper use and application of manure, biosolids, other natural fertilizers; and agricultural water. Equipment used to grow, harvest and transport seed should be designed to enable effective cleaning and sanitation, which should be conducted regularly. Measures should be taken during seed processing and conditioning, storage and transportation to reduce the risk linked to microbial contamination due to improper handling, or exposure to extraneous material. Seed treatments represent an approach to reducing microbial contamination.

- **Animal and human activities**
  - Grazing of domestic animals should not occur in fields while crops are actively being grown for sprout seed production.
  - Wild animals should be excluded from the production area to the extent possible.
- **Manure, biosolids and other natural fertilizers**
  - Manure, biosolids, and other natural fertilizers are potential sources of bacterial pathogens.
  - To reduce the risk linked to seed contamination, only adequately treated/composted manure/biosolids should be utilized during seed production.
  - Extending time intervals between application of manure/compost/biosolids and harvest of seeds would decrease the risk linked to seed contamination.
- **Agricultural water**
  - Fit-for-purpose water for irrigation and other applications should be used to avoid the introduction of pathogens onto seeds.
  - The application method and timing will also impact the risk.
- **Equipment associated with growing and harvesting**
  - Equipment should be designed and maintained to minimize soil intake and seed damage, and prevent introduction of pathogens onto seeds.
  - Equipment should be cleaned and sanitized prior to harvest.
- **Seed Handling**
  - Seeds may become contaminated during harvesting, threshing, and drying.

- Control of moisture content will decrease microbial growth and pathogen viability.

- **Storage and transport**
  - Seeds can become contaminated during storage and transportation.
  - Temperature and humidity should be controlled, and appropriate hygiene conditions implemented, including cleaning & sanitation of equipment used to transport the seeds.
  - Animal and insect controls should be implemented.

- **Seed treatment**
  - Treatment of seeds to reduce the presence of pathogens is a potential-critical control point.
  - Seed treatment can be challenging due to the low water activity of the seeds, and the need to preserve the viability of the seeds as well as their ability to germinate.

- **Microbiological testing of seeds**
  - The likelihood of detecting the presence of pathogens in seeds is extremely low, due to the heterogeneous distribution and low numbers of the pathogens contaminating seeds.

5. Prevention and control measures for sprout production

Preventive and control measures need to be put in place to avoid water, workers, production environment, growth media, or seeds serving as the source of contamination or a vehicle of cross-contamination.

The production process should be based on a HACCP system, where all the steps are well documented and potential critical control points (e.g. decontamination of the seeds) can be identified and controlled. If a problem is identified, a critical revision of all the steps should be performed.

- **Water**
  - Water needs to be fit-for-purpose.
  - The microbiological quality of water used in production and processing of sprouts should be maintained and monitored during the production and/or processing day, particularly if the same water is used in contact with large quantities of product.

- **Workers**
  - Personal health and hygiene measures need to be implemented to avoid workers becoming a vector of contamination for sprouts.

- **Production environment**
  - Sprout producers must take measures to control contamination that may arise from equipment, food and non-food contact surfaces, air, and soil. Proper storage, handling and disposal of waste and effective pest control will minimize the risk linked to sprout contamination.
  - Proper facility design (e.g. differentiation between areas, zones) and operation flow to avoid raw material in contact with the final product will reduce the risk linked to cross-contamination.
  - Environmental monitoring is important to identify sources of contamination, particularly for *L. monocytogenes,* which may become established in the sprout production environment.

- **Soil/growth media**
  - Biological soil amendments of animal origin need to be treated and handled in a manner to minimize the risk of sprout contamination.
- **Seeds**
  - Seeds should be obtained from producers or distributors that follow GAPs and GHPs during production, storage, distribution and commercialization of the seeds.
  - When seeds arrive at a sprout operation, they should be inspected for physical damage and signs of contamination. Once received, seeds should be stored and handled in a manner that will avoid damage, prevent growth of microorganisms, and protect from pests and other sources of contamination.
  - Seed treatment:
    - Due to the difficulty of obtaining seeds that can be guaranteed as pathogen free, decontamination of seeds prior to the sprouting process is recommended to reduce the risk of food-borne illness.
    - Many decontamination treatments are available, including physical and chemical treatments. The effectiveness of treatments is highly variable between published studies and are rarely validated under industrial conditions which is a limitation for the extrapolation of results to industrial applications.
- **Microbial testing**
  - Microbial testing can be done in many different steps of the sprout production. Spent sprout irrigation water has been identified as an appropriate target for microbial testing.
  - Microbial testing should be considered as a verification that the seeds used for sprouting and the production process do not contribute to sprout contamination and may contribute to early detection of contaminated production lots thus preventing entrance into the marketplace.

6. Prevention and control measures during distribution and point-of-sale

- Potential for bacterial growth and contamination can occur during transport, distribution and at point-of-sale due to improper handling and poor personal hygiene, and contamination through comingling with raw commodities and animals/animal products, and exposure to unsanitary surfaces and water.
- Mitigation strategies include training of operators and retailers, as well as the use of clean, enclosed, refrigerated transport vehicles, a clean and sanitary point-of-sale environment, and fit-for-purpose water for cleaning, sanitizing and cooling.
- Sprouts should be kept at refrigeration temperature that will minimize microbial growth for the intended shelf-life of the product. The temperature of storage areas and transport vehicles should be monitored.
- For in-restaurant sprouting, interventions recommended for sprout operations should be considered, including seed sourcing programs, seed treatment (if appropriate), sampling and testing of spent sprout irrigation water (samples to be tested by contact labs) as well as cleaning and sanitizing food contact surfaces.

7. Records and Traceability

- Seed producers and suppliers should have a system to effectively identify lots, trace their associated production sites and agricultural inputs, and allow for the physical retrieval of the seeds in case of a suspected hazard.
- Sprout operations should ensure that records and traceability program are in place to effectively respond to health risk situations.

8. Training

- All personnel involved in the production and handling of seeds for sprouting or sprouts across the supply chain should receive training on principles of food hygiene and food safety as well as personal health and hygiene requirements.
- Seed producers, handlers, distributors, and processors should be aware of GAPs, GHPs and their role and responsibility in protecting seeds intended for sprouting from contamination.
- Interventions designed to reduce microbiological hazards in sprouts can be highly technical and difficult to implement. Specific training related to seed sourcing and storage, seed treatment, sampling and microbial testing and cleaning and sanitizing, and record keeping are required to ensure successful implementation.
- It is important to develop a network of experts and technical support to enable dissemination of accurate and complete information on safe production and handling of sprouts.

References

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https://www.fao.org/3/cb7664en/cb7664en.pdf

Annex 1. List of participants

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