FOOD SAFETY BEST PRACTICES:
ELDERBERRY DRYING

University of California Sustainable Agriculture Research & Education Program

Alicia Baddorf

Gwenaël Engelskirchen

Kristen Farrar

University of California Davis Department of Food Science & Technology

Erin DiCaprio

Thais Ramos

Ruofen Liao

Isabella Tosta

Thank you to our reviewers who graciously contributed their time and expertise to this publication

Katie Reneker, Carmel Berry Company

Susan Mosbacher, University of California Master Food Preserver Program

Kali Feiereisel, Community Alliance with Family Farmers

Patrick Byers, University of Missouri Extension

August 2024

INTRODUCTION

Drying (dehydration) is a simple and relatively inexpensive method to preserve many types of foods, including elderberries and elderflowers. Reducing the water content extends the shelf life of elderberries and elderflowers, reduces the volume and weight, and changes the texture and flavor of the product. Since dried elderberries and elderflowers are typically not consumed on their own but are further processed or incorporated into value-added products, drying can be a useful step to store elderberries and elderflowers until processing. If properly stored, dried elderberries and elderflowers can be further processed into products such as syrups, cordials, vinegars, teas, and other preserves. This guide provides an overview of concepts and considerations for drying elderberries and elderflowers, with an emphasis on food safety practices to minimize the risk of contamination from foodborne pathogens.

Foodborne pathogens, such as Shiga toxin-producing *Escherichia coli* and *Salmonella* spp., can contaminate elderberries and elderflowers at various junctions: in the field or during harvest or post-harvest operations. Since drying is not a "kill step," a process that reduces harmful levels of pathogens in foods, pathogens may survive the drying process and remain viable in storage. Therefore, it is crucial that pre- and post-harvest best management practices are followed to minimize the risk of microbial, physical, and chemical contamination of the final product. Readers may wish to refer to other guides in the series:

- *Food Safety Best Practices: Elderberry Harvest*
  http://ucanr.edu/sites/Elderberry/FoodSafety/Harvest
- *Food Safety Best Practices: Elderberry Post-Harvest Handling*
  http://ucanr.edu/sites/Elderberry/FoodSafety/Post-Harvest
- *Food Safety Best Practices: Elderberry Freezing, Storage, and Holding*
  http://ucanr.edu/sites/Elderberry/FoodSafety/Freezing-Storage-Holding

The purpose of this guide is to convey food safety best practices for drying elderberries and elderflowers, rather than comprehensive guidance around different drying methods. Resources with more information about specific drying techniques are cited and referenced throughout the document.

A note on elderflowers: This guide primarily focuses on elderberry fruit rather than elderflowers. In the case of drying, the food safety principles of cleaning and sanitizing surfaces and equipment used in the drying process apply to both elderberries and elderflowers, while measurements of water activity and moisture content as well as drying systems are mostly specific to elderberries.

UCDAVIS FOOD SCIENCE AND TECHNOLOGY

UNIVERSITY OF CALIFORNIA Agriculture and Natural Resources | Sustainable Agriculture Research and Education Program

FOOD SAFETY CONSIDERATIONS

As with the harvest and post-harvest handling of elderberries and elderflowers, adopting food safety best practices can minimize the risk of spreading pathogens and thus, of foodborne illnesses. We recommend following baseline food safety practices, including cleaning and sanitizing, recordkeeping, verification, and monitoring to minimize food safety hazards (Figure 1).

Figure 1. Elderberry growers and processors should take proper precautions to minimize the risk of contaminating elderberries and elderflowers. Photo by Evett Kilmartin.

CLEANING AND SANITIZING

To minimize the risk of contamination, any drying process should begin with clean and sanitized equipment. The goal of cleaning and sanitation is to reduce the number of microorganisms (including foodborne pathogens) on equipment and in the food processing environment. Cleaning and sanitizing are NOT the same. Cleaning is the process of removing dirt, debris, and grease from an object. Sanitizing is the process of reducing or eliminating microorganisms from the surface of an object. Equipment and tools must be cleaned before they can be sanitized.

Food contact surfaces, equipment directly contacting the elderberries and elderflowers such as drying racks and tables, and non-food contact surfaces (e.g., walls, floors), should be cleaned and sanitized regularly. However, non-food contact surfaces can be cleaned less frequently than food contact surfaces and only require periodic sanitation. Additionally, the drying equipment or processing environment should be considered as a potential point of cross contamination. Equipment should have sanitary design, meaning it is easy to clean and sanitize and made of non-porous materials such as stainless steel or food-grade plastic. For more information about how to clean and sanitize, refer to the previous guide in this series: *Food Safety Best Practices: Elderberry Post-Harvest Handling.*

It is a best practice to create a Standard Operating Procedure (SOP) detailing the steps that will be taken to complete cleaning and sanitation tasks on your farm or facility. Elements of an SOP include **what** is cleaned and sanitized (e.g., drying racks, drying trays), **how** the cleaning and sanitation will be conducted (e.g., what type of sanitizing solution and process used), **who** will complete the cleaning and sanitation task, and **how** the task will be verified and documented (what records will be kept). SOP templates and examples are available on the Community Alliance with Family Farmers' Food Safety Plan Templates webpage: https://caff.org/organic-certification/food-safety-plan-templates. It is also a good idea to keep a cleaning and sanitation log documenting when the cleaning and sanitation took place (e.g., time and date). You or another person in your operation should date and initial each log entry as a verification step.

MONITORING SYSTEMS

As with cleaning and sanitizing procedures, it is a best practice to document and monitor your drying process. Describing the specific steps you take to minimize food safety risks when drying elderberries and/or elderflowers can also be beneficial for quality control. A monitoring program defines what is to be monitored, how it is monitored, how often, and by whom. For example, you may keep a log to track the drying variables for each batch of dried elderberries, including type of dryer, room temperature and humidity, amount of elderberries dried, time of day drying started and finished, whether berries were dried fresh or thawed, temperature of dryer, amount of time spent drying, and a description of the results. The results may vary depending on the drying conditions and tools used.

PRETREATMENT METHODS

Pretreatment methods, such as an ascorbic acid or citric acid dip, are primarily used to inhibit enzymatic browning. Pretreatments are not typically utilized for berries as these commodities are not impacted by enzymatic browning. For information about pretreatment options for drying fruits, see *Preserving Food: Drying Fruits and Vegetables:* https://nchfp.uga.edu/papers/UGA_Publications/uga_dry_fruit.pdf.

Preventive Controls for Human Food Rule

Food businesses that manufacture, process, pack, or hold human food for consumption are regulated by the U.S. Food and Drug Administration's Preventive Controls for Human Food Rule (PC Rule). With the PC Rule, there are different levels of compliance status – full compliance, modified requirements, partial exemption, and full exemption – and differing requirements associated with each. Compliance status depends on criteria such as the risk level of your processing activities, size of your business and the end users of your product. To determine your status under the PC Rule, corresponding requirements, and view a toolkit including a sample letter, flowchart, attestation templates, and a checklist that growers can provide to their buyers to streamline the supplier verification process, we recommend reviewing *Demystifying the Food Safety Modernization Act's Preventive Controls Rule: Supplier Verification Requirements:* https://ucfoodsafety.ucdavis.edu/sites/g/files/dgvnsk7366/files/media/documents/FSMA-Supplier-Verification-Final-0412-21.pdf.

Supplier Verification

If your farm and/or processing business must be in full compliance with the PC Rule and you source fresh elderberries from a grower for drying, you will be required to implement a supplier verification program. However, if your farm and/or processing business meets the standards for a fully or partially exempt facility, you do not need to create a supplier verification program. Regardless of your status under the PC Rule, if you are sourcing elderberries from a grower for drying, it is good practice to verify that the grower uses food safety practices that minimize the risk of chemical, physical, and biological contamination during harvest and handling.

DRYING SYSTEMS AND CONCEPTS

The drying process reduces the amount of free water that is available, which slows microbial growth and some types of chemical reactions in the food. Elderberries can be dried by low-cost methods such as sun drying and solar drying. However, cabinet dryers, dehydrators and freeze dryers expedite the drying process and may result in a superior dried product. In most methods, drying is facilitated by the evaporation of water through heat and is assisted by air circulation carrying away moisture. In the case of freeze drying, water is removed by sublimation, a direct transition from solid to vapor while bypassing the liquid state. Important concepts and considerations for drying include temperature, time, water activity, and moisture content.

ELDERBERRY DRYING SYSTEMS

The shelf-life of elderberries can be extended through relatively simple, inexpensive, and accessible drying methods, even if you are drying on a small-scale. This section will introduce the following drying methods, including advantages and disadvantages: (1) sun drying, (2) solar drying, (3) cabinet or tray drying, (4) dehydration with home-scale dehydrator, and (5) freeze drying.

KILL STEP

A kill step is a process between harvest and consumption that significantly minimizes the presence of any pathogens present. Examples of kill steps include cooking, blanching, distilling, or pasteurizing. Drying is not considered a kill step. Although the drying process may destroy some microbes depending on temperature, foodborne pathogens can survive the drying process and remain inactive but viable until a better environment for growth is encountered.

Sun Drying

Elderberries are placed on outdoor drying racks one layer deep (Figure 2). It is recommended to suspend netting or cheese cloth over berries to protect from birds, insects, and pests. Some elderberry producers recommend placing table legs in containers of water to prevent insects from crawling up into elderberry fruit and flowers.

Sun drying requires constant exposure to direct sunlight during the day, with a recommended temperature of 98°F (minimum 85°F) and relative humidity below 60% (University of Georgia Cooperative Extension Service, n.d.). Sun drying is not recommended in areas with high humidity, which could cause the food product to mold before it dries. It is recommended that fruits dried outdoors be covered or brought under shelter at night as the cool night air can add moisture back to the fruit.

Advantages

- Low-cost, easily accessible, simple drying method.

Disadvantages

- No control over temperature and humidity (depends on weather).
- Relatively slow process.
- Exposed to contamination from the environment.

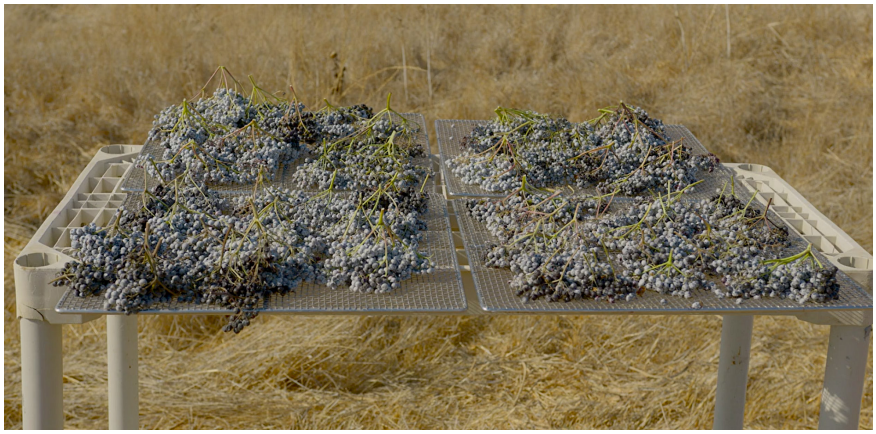


Figure 2. Sun drying can be used to dry elderberries outdoors. Elderberries should be placed on drying racks one layer deep. Photo by Ethan Ireland.

Drying Equipment Material Guidance

The following guidance, from the Cooperative Extension Service at the University of Georgia, Athens, is recommended when choosing drying equipment for sun or air drying:

USE screens made of:

- Stainless steel
- Food grade plastic

AVOID screens made of:

- Hardware cloth, which is galvanized metal cloth that is coated with cadmium or zinc. These metals can oxidize, leaving harmful residues on the food.
- Copper, which destroys vitamin C and increases oxidation.
- Aluminum, which tends to discolor and corrode.

Solar Drying

Solar drying uses radiation energy from the sun to dry elderberries. A greenhouse may be used as a solar drying structure for elderberries. In a manufactured solar dryer, a reflective surface like aluminum foil or glass inside the dehydrator increases the temperature of the sun by 20 to 30°F.

For more information about solar drying: Preserving Food: Drying Fruits and Vegetables: https://nchfp.uga.edu/papers/UGA_Publications/uga_dry_fruit.pdf.

Advantages

- Relatively simple and low-cost to construct.
- Uses renewable energy.
- Reduces the risk of food spoilage or molding when compared to sun drying due to shorter drying times.

Disadvantages

- Relatively poor control over drying conditions and lower drying rates than those found in artificial driers, which can result in low quality product and greater variability.

Cabinet or tray drying

Trays containing elderberries are placed in a closed chamber. The insulated cabinet is fitted with shallow mesh or perforated trays to provide airflow through the trays. Heated, dry air circulates between the shelves and promotes uniform air distribution through each tray until the drying process is complete.

Advantages

- Inexpensive and relatively simple to construct.
- Closed chamber protects dried elderberries and elderflowers from exposure to pests and weather conditions.
- Drying environment is more controlled than outdoor drying conditions (sun and solar drying).

Disadvantages

- Manufactured cabinet dryers can be expensive.

Dehydration with home-scale dehydrator

Elderberries are arranged in single layers on drying racks and warm air is circulated to remove moisture from the fruit. Two types of food dehydrators are available: horizontal air flow and vertical air flow (differences are noted below).

Advantages

- Available from a number of retailers in the U.S.
- With horizontal air flow dryers, the trays do not need to be rotated and the elderberries will dry evenly.
- For vertical air flow dryers, additional trays can be purchased to dry more product at a time.

Disadvantages

- Limited space means that only small batches of elderberries can be dried at once, making it unsuitable for larger scale drying.
- With vertical air flow dehydrators, trays must be rotated for more even drying.
- For horizontal air flow dehydrators, the number of trays is limited to the frame of the dehydrator.

Figure 3. Freeze dryer, which can be used to dehydrate elderberries. Operational, equipment, and energy costs for freeze drying are much higher than those for other drying systems. Photo by Ethan Ireland.

Freeze drying

Freeze drying is a method of water removal that involves dehydration by sublimation under low temperature and vacuum conditions (Figure 3).

Advantages

- Freeze dried food products typically possess superior sensory and nutritional qualities when compared with food products dehydrated by other techniques (Figure 4).

Disadvantages

- Much higher equipment costs than other types of drying systems.
- Higher energy and operational costs compared to other types of drying systems because of long periods of cooling and running vacuum pump.

Figure 4. Freeze dried elderberries may possess superior sensory and nutritional qualities compared to elderberries dried using other techniques. Photo by Ethan Ireland.

GENERAL DRYING CONCEPTS AND CONSIDERATIONS

When drying elderberries, it is useful to understand key concepts that will aid in the monitoring and production of a safe and high-quality product. These include temperature of the drying environment and time spent drying, water activity and moisture content of the dried elderberries, and conditioning.

TEMPERATURE

If using a dehydrator, several sources recommend drying fruit and other foods at 140°F (Kendall & Sofos, 2012; National Center for Home Food Preservation, 2024; University of Georgia Cooperative Extension Service, n.d.). If the drying temperature is too low at the beginning of the drying process, spoilage microorganisms may grow before the elderberries are properly dried, leading to loss of product. If the temperature is too high or the humidity too low, there is a danger of moisture being removed too fast, which can cause "case hardening" in elderberries, a hardening of the outer cells of the product. Case hardening makes it more difficult for moisture to escape, preventing the final product from drying properly, and eventually causing the elderberries to mold. Wilson et al. (2016) suggest using a dehydrator with humidity control to help ensure the elderberries dry throughout.

For oven-drying, temperature recommendations range from 120-140°F. Wilson et al. (2016) suggest that a temperature of 120°F is ideal for drying elderberries in an oven, and a temperature over 140°F will cause elderberries to cook. The University of Georgia Cooperative Extension Service (n.d.) suggests 140°F for oven-drying food, keeping the oven door open 2 to 6 inches for air circulation and running a fan outside the oven by a door.

TIME

Drying time varies according to size and moisture content of the elderberries, dryer temperature, type of drying equipment, tray load, and pretreatment method.

WATER ACTIVITY

Water activity is the amount of "free water" in a food, or a measure of how much water is available, not bound to other solids like salt or sugar, in the product. Reducing the water activity of a food can reduce spoilage of a food product caused by unwanted chemical and physical changes or microbial growth. Water activity is measured in values from 0.0 to 1.0. A water activity of 0.85 or below will inhibit the growth of pathogenic bacteria (e.g., *Salmonella* spp., Shiga toxin-producing *Escherichia coli*, *Listeria monocytogenes*, *Staphylococcus aureus*), though they may survive in food (Liu et al., 2022). Dried fruits typically have a water activity range of 0.60-0.65.

Calculating appropriate dryness of elderberries

According to the University of Vermont Extension's (2016) manual on elderberry production and enterprise viability:

The standard calculation for achieving appropriate dryness is a finished weight for dried berries that is one fourth of the starting weight of the fresh berries. Measure the weight of the fresh berries before drying and then divide this total by four, to estimate the target finished weight goal. Then monitor the weight of the berries through the drying process until the desired end weight is reached (Wilson et al., 2016).

For example, following this formula:

Starting weight of elderberries (before drying): **4 pounds**

Target ending weight of elderberries (after drying): **1 pound**

Water activity can be measured using a laboratory instrument called a water activity meter. A small sample of the food is placed in the measurement chamber, and the water activity is determined from its vapor pressure. If you do not wish to purchase a water activity meter, you can send a sample to a third-party laboratory to measure water activity for an estimated cost of $15-30 per sample. To find a lab offering water activity analysis of dried fruit on a lot to lot basis, refer to: https://ucfoodquality.ucdavis.edu/food-industry-contacts/lab-analysis.

MOISTURE CONTENT

Moisture content is a measure of the amount of water in a product compared to the product's total mass and is not the same as water activity (Callahan, 2021). Moisture content can be determined by weight loss upon drying. The moisture content of elderberries affects its taste, texture, and shelf life. Measuring moisture content by determining the weight loss by drying will be a more accurate method for assessing "dryness" of the elderberries as compared to using the "finger pinch method" or visual observations. Regardless of drying method, it is recommended that the moisture content of dried elderberries be between 10-20%.

How to measure moisture content:

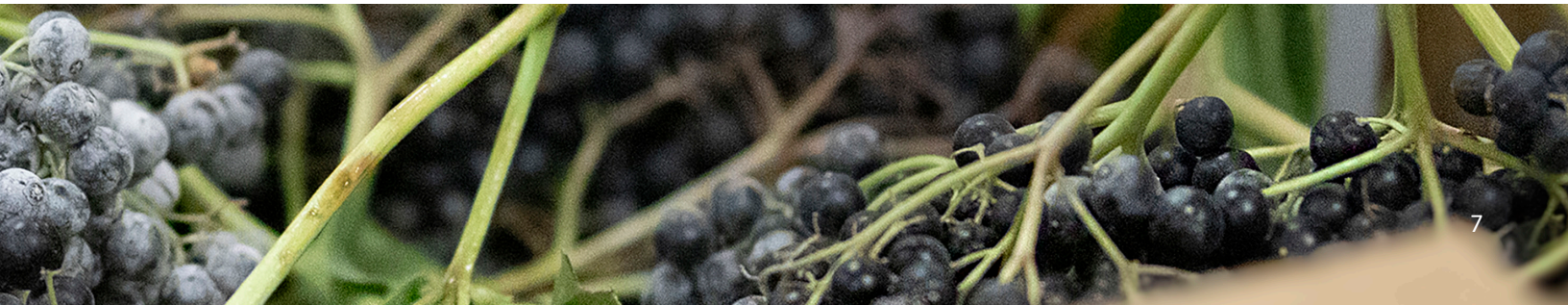
1. Weigh a sample of your elderberries before drying (original mass)
2. Weigh the same sample after drying (dry mass)
3. Subtract the dry mass from the original mass (original mass - dry mass)
4. Divide that number by the original mass (original mass - dry mass) / original mass
5. To calculate the moisture content, convert to a percentage by multiplying that by 100

Example:

1. Original mass = 10 lbs
2. Dry mass = 8 lbs
3. 10 - 8 lbs = 2 lbs
4. 2 / 10 lbs = 0.2 lbs
5. 0.2 lbs x 100 = 20% moisture content

CONDITIONING

Conditioning is a method that can aid with the even distribution of moisture across fruit and reduce the chance of mold and spoilage (University of Georgia Cooperative Extension Service, n.d.). Conditioning is an optional step for drying elderberries depending on the type of equipment and temperature used for the drying process and can be done after measuring moisture content. Dried fruit should be conditioned before packaging and storage. To condition elderberries, loosely pack them in large, tightly sealed, plastic or glass containers and shake or stir daily for two to four days to equalize the moisture, with excess moisture in some elderberries being absorbed by drier elderberries. When completed, check several elderberries to make sure they are dry enough for storage. If the berries are not dry enough or you notice condensation forming in the container, return the elderberries to the dryer for more drying and repeat the conditioning process. The process can take seven to ten days.



Case Study: UC Davis Elderberry Drying Trial

The UC Davis Food and Science Technology Department conducted a trial in 2023 to measure the amount of time needed to reach ideal water activity and moisture content levels in three different drying systems: a home dehydrator, cabinet dryer, and freeze dryer. Findings are summarized in Table 1.

Table 1. Elderberry Drying Data

DATA POINT	TYPE OF DRYING EQUIPMENT USED		
	Home dehydrator	Cabinet dryer	Freeze dryer
Temperature	150°F†	150°F	Shelf temperature: -20°C Chamber temperature: -75°C††
Total time	5 hours, 19 minutes	5 hours, 33 minutes	5 days
Starting water activity	0.9895	0.9895	0.9895
Ending water activity	0.406	0.327	0.294
Starting moisture content	81.48%	81.48%	81.48%
Ending moisture content	16.67%	17.32%	20.84%

†As noted in this guide, several resources recommend using 140°F for drying fruit and other foods in a dehydrator.

††Follow the recommended process for the freeze drying equipment provided by the manufacturer; typically the chamber will be set at a temperature of -40 to -80°C for the primary drying step.

ELDERFLOWER DRYING

Figure 5. Elderflowers on racks in a drying room. Photo from Carmel Berry Company.

Elderflowers can be dried by placing the entire cyme on a piece of butcher or parchment paper and storing them in a warm, dry location (Figure 5). Elderflowers can also be dried in a dehydrator at the lowest temperature possible to avoid discoloration of the flowers. Based on experience from elderberry growers and processors, a temperature ranging from 80°F to 105°F is desirable for drying elderflowers (Patton, 2018). Once the flowers are dry, separate them from their stems by gently rubbing them into a bowl or bucket. Remove any stems or leaves, as they contain a naturally occurring toxin, cyanogenic glycoside, which can cause gastrointestinal upset or other symptoms if consumed. If elderflowers are not processed using a kill step before being sold, it is advisable to send a sample of each lot to a lab for microbiological testing. For a list of third-party labs capable of conducting microbiological testing: https://ucfoodquality.ucdavis.edu/food-industry-contacts/lab-analysis.

PACKAGING AND STORAGE

The packaging material can have an impact on the quality of the final dried elderberry product. For more information on choosing a good packaging material for storage, read our guide, *Food Safety Best Practices: Elderberry Freezing, Storage, and Holding*.

Once packaged, store your dried elderberries or elderflowers in a cool and dark area until they are ready to sell or use in value-added products such as syrups, jams, or cordials.

CONCLUSION

Drying is an effective method for extending the shelf-life of elderberries and elderflowers and can be achieved through simple methods such as sun drying, solar drying, and dehydration. Food safety measures – including cleaning and sanitizing equipment and contact surfaces – should be implemented to prevent contamination of elderberries and elderflowers, and thus, foodborne illness. Additionally, monitoring systems that take into consideration drying conditions and product characteristics including temperature, time, moisture content, and water activity can contribute to a high quality end-product. Once elderberries and elderflowers are dried, use of proper packaging supports proper long-term storage. To learn more about the freezing, storage, and holding of elderberries, read the next guide in the series, *Food Safety Best Practices: Elderberry Freezing, Storage, and Holding*.

RESOURCES

DRYING METHODS

A Comprehensive State-of-the-Art Review on the Recent Developments in Greenhouse Drying. https://doi.org/10.3390/en15249493

Batch uniformity and energy efficiency improvements on a cabinet dryer suitable for smallholder farmers. Journal of Food Science and Technology. https://doi.org/10.1007/s13197-014-1544-y

Drying. National Center for Home Food Preservation. University of Georgia. https://nchfp.uga.edu/how/dry/drying-general/sun-drying/

Drying and Curing Herbs and Flowers (Hops, Hemp, and Everything Else!). UVM Extension Ag Engineering. https://blog.uvm.edu/cwcallah/2021/02/23/drying-and-curing-herbs-and-flowers-hops-hemp-and-everything-else/

Drying and Different Techniques. International Journal of Food Nutrition and Safety. https://www.researchgate.net/publication/356187901_International_Journal_of_Food_Nutrition_and_Safety_2017_81_45-72_International_Journal_of_Food_Nutrition_and_Safety_Drying_and_the_Different_Techniques

Home Drying Foods. Utah State University. https://extension.usu.edu/preserve-the-harvest/research/drying-methods

Solar drying of fruits – A comprehensive review. Materials Today. https://doi.org/10.1016/j.matpr.2020.04.041

Solar greenhouse drying: A review. Renewable and Sustainable Energy Reviews. https://doi.org/10.1016/j.rser.2013.08.084

ELDERBERRY INFORMATION & BEST PRACTICES

Elder Processing. University of California Sustainable Agriculture Research and Education Program (UC SAREP), UC Agriculture and Natural Resources. https://ucanr.edu/sites/Elderberry/HarvestMarket/Process/

FOOD SAFETY REGULATIONS

Demystifying the Food Safety Modernization Act's Preventive Controls Rule: Supplier Verification Requirements. Community Alliance with Family Farmers. https://caff.org/wp-content/uploads/2021/04/FSMA-Supplier-Verification-Final-0326-21.pdf

Frequently Asked Questions: FSMA Food Traceability Rule. U.S. Food & Drug Administration. https://www.fda.gov/food/food-safety-modernization-act-fsma/frequently-asked-questions-fsma-food-traceability-rule#TKS1

Key Facts about Preventive Controls for Human Food. U.S. Food and Drug Administration. https://www.fda.gov/files/food/published/Key-Facts-about-Preventive-Controls-for-Human-Food.pdf

Understanding FSMA: HACCP, HARPC and the Preventive Controls for Human Food Rule. PennState Extension. https://extension.psu.edu/understanding-fsma-haccp-harpc-and-the-preventive-controls-for-human-food-rule#section-15

FOOD SAFETY TEMPLATES

Food Safety Plan Templates. Community Alliance with Family Farmers. https://caff.org/food-safety/food-safety-plan-templates/

REFERENCES

Callahan, C. (2021). Drying and Curing Herbs and Flowers (Hops, Hemp, and Everything Else!). University of Vermont Ag Engineering. Retrieved June 3, 2024, from https://blog.uvm.edu/cwcallah/2021/02/23/drying-and-curing-herbs-and-flowers-hops-hemp-and-everything-else/

Kendall, P. and Sofos, J. (2012). Drying Fruits. Colorado State University Extension. Retrieved October 10, 2023, from https://extension.colostate.edu/topic-areas/nutrition-food-safety-health/drying-fruits-9-309/

Liu, S., Roopesh, M.S., Tang, J., Wu, Q., and Qin, W. (2022). Recent development in low-moisture foods: Microbial safety and thermal process. Food Research International, 155(111072), 1-15. https://doi.org/10.1016/j.foodres.2022.111072

National Center for Home Food Preservation. (2024). Drying. Retrieved May 20, 2024, from https://nchfp.uga.edu/how/dry#gsc.tab=0

Patton, Christopher J. (2018). Dried Elder Berry & Flower Ingredients. Midwest Elderberry Cooperative. Retrieved March 25, 2024, from https://grow.midwest-elderberry.coop/overview/dried-elder-berry-and-flowe.pdf

University of Georgia Cooperative Extension Service. (n.d.). Preserving Food: Drying Fruits and Vegetables. Retrieved May 20, 2024, from https://nchfp.uga.edu/papers/UGA_Publications/uga_dry_fruit.pdf

Wilson, R., Nickerson, G., Fried, D., Hayden, J., Masé, G., Hardie, T., Faulkner, J., Sisock, M., Jackson, T.L., Handley, D., Peronto, M. (2016). Growing Elderberries: A Production Manual and Enterprise Viability Guide for Vermont and the Northeast. University of Vermont Extension. Retrieved September 19, 2023, from https://www.uvm.edu/sites/default/files/media/ElderberryGuideComplete.pdf

The preceding information is provided in good faith, but without warranty. Material presented here is for general information purposes; product references are intended as examples and should not be construed as recommendations or endorsements. This guide is intended as an educational resource and not as advice tailored to a specific operation, or as a substitute for actual guidance from regulatory agencies. We will not be responsible or held liable directly or indirectly for consequences resulting from use of information provided by this document.

This resource was supported in part by the U.S. Department of Agriculture, National Institute of Food and Agriculture, Food Safety Outreach Program (award 2020-70020-33031). The information within has not been formally disseminated by the U.S. Department of Agriculture and should not be construed to represent any agency determination or policy.

UCDAVIS FOOD SCIENCE AND TECHNOLOGY

UNIVERSITY OF CALIFORNIA Agriculture and Natural Resources | Sustainable Agriculture Research and Education Program