

FREE REPORT

Keeping More of Every Harvest: A Practical Report on Cold Chain and Shared Food Processing

How small and mid-size producers can cut post-harvest loss, protect quality and add value close to home.

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Who this report is for

This report is for small and mid-size farms, food hubs, cooperatives and rural community leaders in the United States who watch good food go soft, get rejected at the dock or stay in the field because there is no way to cool, store or sell it in time.

You do not need an engineering background. This report goes deeper than our introductory articles: the numbers behind the problem, temperature targets for common crops, how cooling and storage options compare, how shared processing works, and how to plan an upgrade.

To show how these ideas look on the ground, Section 5 includes real examples from two North American bioregions: Cascadia, the Pacific Northwest region that spans Washington and British Columbia, and the Northeast, in western Massachusetts.

Key findings at a glance

- **Loss starts early.** FAO estimates that about 14 percent of the world's food is lost after harvest and before it reaches retail. A North Carolina field study found edible vegetables left in fields equal to about 42 percent of what was actually marketed.
- **Temperature is the biggest lever you control.** Each crop has a target temperature and humidity range. Missing it in either direction causes rot, wilting or chilling injury.
- **The first hours matter most.** Removing field heat quickly (precooling) does more for shelf life than a perfect storage room filled with warm product.
- **There is no single "right" cooler.** Room cooling, forced-air cooling, hydrocooling, icing and vacuum cooling each fit different crops, volumes and budgets.
- **Sharing spreads the cost.** Food hubs and shared processing let producers use equipment, licensed space and buyers that none could justify alone.
- **Food safety rules shape the design.** The FSMA Produce Safety Rule and state licensing rules affect water, sanitation, layout and records. Check them before you build.
- **Byproducts are a resource.** Trimmings and culls can become animal feed, compost or energy, and cold rooms can draw power from on-site solar. That is where cold chain becomes part of a connected system.



1. Where and why loss happens: the numbers

Loss happens between harvest and retail. **Waste** happens at retail, food service and in homes. This report focuses on loss, where farms and hubs have the most control.

Here is what the better-known studies say:

- **Global post-harvest loss.** FAO's *State of Food and Agriculture 2019* estimated that around 14 percent of food produced is lost after harvest up to, but not including, retail.
- **Global waste further down the chain.** UNEP's *Food Waste Index Report 2024* estimated that about 1.05 billion tonnes of food were wasted in 2022 at the retail, food service and household levels, roughly 19 percent of food available to consumers.
- **Loss on farms.** WWF's 2021 report *Driven to Waste* estimated that about 1.2 billion tonnes of food are lost on farms worldwide each year, a larger figure than earlier estimates suggested.
- **The United States.** ReFED estimates that 29 percent of the roughly 240 million tons of the US food supply went unsold or uneaten in 2024.
- **A field-level look.** Johnson and colleagues (2018, *Agricultural Systems*) measured 68 fields of eight vegetable crops on nine North Carolina farms. The edible produce left behind averaged about 5,100 kilograms per hectare, equal to roughly 42 percent of the marketed yield.

These figures use different methods and should not be added together. But they agree that a large share of loss happens before food reaches a store.

FOUR NUMBERS WORTH KNOWING (EACH FROM A DIFFERENT STUDY)

14%
of world food lost after harvest, before retail (FAO, 2019)

19%
of food available to consumers wasted (UNEP, 2024)

29%
of the US food supply unsold or uneaten (ReFED, 2024)

42%
edible vegetables left in North Carolina fields, vs. marketed yield (Johnson et al., 2018)

QUICK SELF-CHECK: WHERE IS YOUR FARM LOSING FOOD?

Rows or plantings left unharvested because prices, labor or timing did not line up

Produce graded out for size, shape or blemishes that is still good to eat or process

Harvested crops waiting in the sun or in a truck before they reach a cooler

One cooler holding crops that need different temperatures or humidity

Ethylene-producing fruit stored next to sensitive greens or vegetables

Bruising from deep bins, rough handling or long, bumpy deliveries

Surplus at peak season with no buyer, processing outlet or storage space

No simple record of how much is lost, where and why

HOW TO USE THIS LIST

Tick every line that applies, then estimate roughly how much product each one costs you in a normal week. The two or three biggest items are where cooling, shared processing or new buyers will pay back fastest. The rest of this report shows options for each.

ILLUSTRATION (HYPOTHETICAL NUMBERS): ONE WEEK OF TRACKING

A 10-acre mixed vegetable farm weighs what it throws away for one July week. Greens wilted while waiting for the cooler: 120 lb. Tomatoes graded out for cracks and size: 300 lb. Squash with no buyer after a big pick: 250 lb. The cull tomatoes and surplus squash point toward a processing outlet such as sauce, frozen or a food bank contract. The wilted greens point toward faster cooling right after harvest. Seeing the numbers side by side makes it clear which fix to tackle first.

> *...these high figures indicate the need for a reevaluation of the food loss estimates at the agricultural level in the US.*
>
> Johnson et al., field study of 68 vegetable fields on nine North Carolina farms, *Agricultural Systems* (2018)

The authors noted that the widely cited US estimate of about 40 percent food loss and waste does not include losses on farms. Their count covered both marketable produce and edible produce that failed appearance standards, left behind after the main harvest. That is why the self-check above lists

unharvested rows and graded-out seconds alongside spoilage: losses that never reach a cooler are the easiest to miss.

Why it happens on small and mid-size farms

The causes are usually practical:

1. **Field heat.** Produce picked at 85°F keeps respiring fast. It uses up its sugars and water and starts to decline within hours.
2. **No place to hold product.** Without storage, a farm must sell everything immediately, often at a low price, or let it spoil.
3. **Cosmetic and size standards.** Buyers may reject product that is safe and edible but not the right shape or size.
4. **Labor and timing.** If the price will not cover the cost of picking, the crop stays in the field.
5. **Handling damage.** Bruises and cuts from rough handling, overfilled bins or long, hot transport open the door to decay.
6. **No outlet for seconds.** Without processing (freezing, drying, sauces, juice), imperfect product has nowhere to go.

Cold chain addresses the first, second and fifth causes. Shared processing addresses the third and sixth.

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2. Temperature and humidity targets for major crop groups

Produce is alive after harvest. Cooling slows respiration, water loss and decay. But crops differ. Some tolerate near-freezing temperatures. Others are **chilling-sensitive** and get damaged below about 50°F.

> **WHY A FEW DEGREES MATTER**
>
> Postharvest specialists describe respiration with a rule of thumb: for many fresh crops, every 18°F (10°C) rise in temperature roughly doubles or triples the rate of respiration, and with it the rate of decline. That is why produce held warm for a morning can lose days of shelf life.

The table below summarizes typical storage conditions drawn from the USDA *Agriculture Handbook 66* and the UC Davis Postharvest Center produce fact sheets. Treat it as a starting point. Variety, maturity and how long you plan to store all matter, so check the crop-specific fact sheet before setting your room.

Crop group	Examples	Typical temperature	Typical relative humidity	Notes
Leafy greens and cole crops	Lettuce, spinach, kale, broccoli, cabbage	32 to 36°F	95 to 100%	Wilt fast if humidity is low. Many are ethylene-sensitive.
Root crops (topped)	Carrots, beets, radishes, turnips	32 to 36°F	95 to 100%	Can store for months when cold and humid. Keep carrots away from ethylene.
Berries	Strawberries, blueberries, raspberries	32 to 34°F	90 to 95%	Very short life. Speed of cooling is critical.
Sweet corn and peas	Sweet corn, snap peas	32 to 34°F	95 to 98%	Sugars convert to starch quickly when warm.
Apples and pears	Most varieties	About 30 to 40°F	90 to 95%	Some apple varieties are chilling-sensitive. Strong ethylene producers.
Potatoes (table, cured)	Fresh-market potatoes	About 40 to 50°F	90 to 95%	Too cold raises sugars; keep dark to prevent greening.
Dry bulbs	Onions, garlic	32 to 36°F	65 to 70%	Need low humidity. Do not store with leafy greens.
Warm-season fruiting vegetables	Cucumbers, peppers, summer squash, eggplant	45 to 55°F	90 to 95%	Chilling-sensitive. Pitting and decay if held too cold.
Tomatoes	Mature green to ripe	50 to 60°F or warmer	85 to 95%	Chilling-sensitive. Cold harms flavor and ripening.
Winter squash and pumpkins	Butternut, acorn	50 to 55°F	50 to 70%	Dry storage. Cure some types first.
Sweet potatoes (cured)	All types	55 to 60°F	85 to 95%	Cure first, often around 85°F and high humidity for several days.
Herbs	Basil	About 50°F or warmer	90 to 95%	Basil blackens when chilled. Most other herbs prefer it cold.

What the table means for your building

A single room at 34°F suits greens, roots and berries but injures tomatoes, cucumbers and basil. Onions and squash want dry air; greens want nearly saturated air.

Most diversified farms need **at least two zones**: a cold, humid room (about 32 to 36°F) and a cool room (about 50 to 55°F), sometimes plus dry storage for onions and squash. Planning zones from the start is cheaper than retrofitting.

ILLUSTRATION: SORTING A MIXED VEGETABLE FARM INTO ZONES

Using the table above, a farm growing greens, carrots, strawberries, sweet corn, tomatoes, cucumbers, basil, onions and winter squash might plan:

- **Cold and humid (32 to 36°F, 90 to 100% RH):** greens, carrots, strawberries, sweet corn.
- **Cool (about 50 to 55°F, 85 to 95% RH):** tomatoes, cucumbers, basil.
- **Dry storage:** onions cold and dry (32 to 36°F, 65 to 70% RH); winter squash cool and dry (50 to 55°F, 50 to 70% RH).

If only one cold room is possible at first, use it for the cold, humid group and hold chilling-sensitive crops in the coolest shaded space you have.

Ethylene is the other compatibility issue. Apples, pears, ripe tomatoes and some melons give off ethylene gas, which speeds yellowing in broccoli, bitterness in carrots and spotting in lettuce. Mixed loads should separate producers from sensitive crops, or use ventilation.

SIGNS YOUR COOLING SETUP NEEDS ATTENTION

- Product in the middle of stacks is still warm the next morning.
- The cooling unit runs constantly and the room still drifts up on hot days.
- Coils ice up often, or water pools on the floor.
- Greens wilt or roots shrivel even though the temperature reads correctly (check humidity).
- Tomatoes, cucumbers or basil show pitting or blackening (check for chilling injury).

WORKED EXAMPLE: WHAT A WARM MORNING COSTS

Use the rule of thumb from the box at the start of this section. Strawberries picked at 86°F are 54°F (30°C) warmer than their 32°F storage target. That is three 18°F steps. At two to three times per step, berries left at field temperature respire roughly 8 times (2 x 2 x 2) to 27 times (3 x 3 x 3) faster than berries brought down to 32°F.

Put another way, one hour waiting in the sun can use up as much shelf life as 8 to 27 hours in the cooler. The figures are approximate and vary by crop, but they show why the table above calls speed of cooling critical for berries, and why shade and a quick trip to the cooler pay off.

3. Cold storage options compared

Option	Best fit	Strengths	Watch out for
DIY walk-in with an air-conditioner controller	Small farms, one cold zone, modest volume	Low upfront cost; can be built from insulated panels or a framed, well-insulated room; parts are widely available	Limited capacity to pull heat out of large warm loads; coils can ice up; relies on good insulation and a tight door
Commercial walk-in with refrigeration unit	Mid-size farms, hubs, daily large loads	Designed for the job; better humidity control; can be sized for heavy use	Higher cost; needs a qualified refrigeration technician for install and service
Refrigerated shipping container ("reefer")	Farms that need a quick, movable cold room	Pre-insulated and sealed; can be relocated	Built for holding already-cold product, not removing field heat; high power draw on older units
Solar-powered cold room	Off-grid sites, farms with existing solar, places with unreliable power	Lower operating cost; resilience during outages	Needs a plan for nights and cloudy days (batteries or thermal storage); design must match local sun
Root cellar or earth-sheltered room	Long-term storage of roots, potatoes, apples in cool climates	Very low energy use	Limited temperature control; depends on climate and soil

The DIY walk-in approach

Many small farms have built walk-ins using a standard window air conditioner paired with an aftermarket controller. Normally, a window unit's thermostat stops it from cooling below about 60°F. The controller tricks the unit into running colder, often into the mid-30s °F, while watching the coil so it does not freeze solid.

Extension programs, including the University of Kentucky's guide to building a small-farm walk-in cooler, describe how to build these rooms. The keys they emphasize are:

- **Insulation first.** Thick insulation (often R-25 or more in walls and ceiling) and a tight, well-sealed door matter more than the cooling unit.
- **Right-size the air conditioner.** The unit must be big enough for the room and the heat load. Undersized units run constantly and still fall short.
- **Hold, do not precool.** These rooms are good at keeping cold product cold. They struggle to remove field heat from large, warm harvests. Pair them with a precooling step when volumes grow.

Solar-powered cold rooms

Solar cold rooms pair photovoltaic panels with a refrigeration system. The design challenge is that cooling is needed around the clock while the sun is not. There are two common answers:

1. **Battery storage**, which stores electricity for night use.
2. **Thermal storage**, which uses extra daytime power to freeze water or a phase-change material. That stored "cold" is released overnight. Many designs for small farms lean on thermal storage because it can be simpler and longer-lasting than batteries.

Cooling demand peaks on hot, sunny days, so solar output and cooling needs line up fairly well. Design for the hottest week and several cloudy days in a row.

HAVE THESE ANSWERS READY BEFORE YOU CALL A REFRIGERATION CONTRACTOR

- Which crops, and how many pounds come in on your busiest harvest day
- How warm the product is when it arrives, and how fast it must be cooled
- How many temperature zones you need, and the target temperature and humidity for each
- Your electrical service (amps and voltage) and whether it can be upgraded
- Whether the room will precool, only hold, or both
- How you will know if the room fails at night or over a weekend

4. Precooling methods compared

Precooling means removing field heat quickly, ideally within hours of harvest. Postharvest specialists often express cooling speed as "seven-eighths cooling time," the time it takes to remove seven-eighths of the difference between the product's starting temperature and the cooling medium's temperature. Faster methods reach that point in minutes or a few hours. Room cooling can take a day or more.



Cold water rinsing and hydrocooling remove field heat fast, but the water must be kept clean and sanitized.

Method	How it works	Good for	Limitations
Room cooling	Product sits in a cold room	Crops that cool easily or are not highly perishable; small volumes	Slowest method; packed boxes in the middle stay warm
Forced-air cooling	A fan pulls cold air through vented boxes stacked against a tarp	Berries, tomatoes, peppers, many fruits and vegetables	Needs vented packaging and correct stacking; can dry product if run too long
Hydrocooling	Cold water is sprayed over or used to immerse product	Sweet corn, broccoli, carrots, asparagus, cantaloupe	Water must be kept clean and sanitized; not for crops harmed by wetting such as berries
Package or top icing	Crushed ice or slurry is packed with product	Broccoli, sweet corn, green onions	Heavy; melt water must drain; only for crops that tolerate ice contact
Vacuum cooling	Low pressure makes water evaporate from the product, cooling it	Lettuce and other leafy greens with lots of surface area	Expensive equipment; usually a shared or commercial service

Simple ways to start

A forced-air cooler can be built inside an existing walk-in using a fan, a tarp and a stack of vented boxes. The FAO-published manual *Small-Scale Postharvest Handling Practices* by Kitinoja and Kader, produced with UC Davis, shows low-cost designs for many of these methods.

Free steps help too: harvest in the cool of the morning, keep picked produce shaded and move it to cooling quickly.

PICK A PRECOOLING METHOD FOR EACH CROP

- Look up the crop in the table above and in the UC Davis Postharvest Center fact sheets
- Rule out hydrocooling and icing for crops harmed by wetting, such as berries
- For forced air, confirm your boxes are vented and you have a fan, tarp and space to stack
- For any water-based method, plan how you will sanitize and monitor the water
- Start with the most perishable crop you sell, and time how long it takes to chill

Water and food safety in precooling

Any water that touches produce after harvest, including hydrocooler and ice water, is subject to food safety expectations. Under the FSMA Produce Safety Rule, covered farms must use water that meets safety standards for harvest and post-harvest uses and must manage it to avoid spreading contamination. Recirculated hydrocooler water needs monitoring and sanitizing. Ask your state

produce safety program or extension office for current guidance before setting up a water-based cooler.

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5. Shared processing and food hub models

A food hub, as described in the USDA *Regional Food Hub Resource Guide*, is a business or organization that actively manages the aggregation, distribution and marketing of source-identified food, mainly from local and regional producers. Many hubs also offer cold storage, light processing, or both.

Common models

- **Producer cooperative.** Farmers own the facility together and share profits and decisions.
- **Community-run hub.** A community organization runs the facility, often with a mission focus on farm viability or food access.
- **Privately owned hub.** A business buys from farms and sells to institutions, retailers and restaurants.
- **Shared-use or incubator kitchen.** A licensed kitchen that producers rent by the hour to make value-added products.

What shared processing can do

Processing gives "seconds" a market. Frozen berries, salsa, dried fruit and cut vegetables for schools can all start from product that might otherwise be discarded. Shared facilities give producers access to blast freezers, kettles, dehydrators and packaging equipment they could not justify alone.

Regional examples

Climate, crop mix and distance to buyers shape what a shared facility needs, so it helps to look at what already works in your own region. Here are examples from two bioregions.

> **CASCADIA: A FARMER-OWNED HUB AND A PROVINCIAL NETWORK**
>
> In the Pacific Northwest, the Puget Sound Food Hub Cooperative in Mount Vernon, Washington, markets, aggregates and distributes farm products from regional producers. It began in 2009 to 2010 as a small wholesale farmers market and became a farmer-owned cooperative in 2016. A 2023 Washington State University Extension case study describes it working from a rented 14,000 sq ft warehouse with a 4,000 sq ft cooler, a 360 sq ft freezer and three trucks. In early 2020 it had 64 members, 52 of them farmers. Across the border, British Columbia has funded the BC Food Hub Network since 2019: twelve regional food hubs that offer growth-stage food businesses shared-use space, equipment and services at affordable rates. Several list cold or refrigerated storage, including hubs in Creston, Kamloops, Victoria and Port Alberni.

THE NORTHEAST: A SHARED-USE PROCESSING CENTER

In western Massachusetts, the Western Mass Food Processing Center in Greenfield is a shared-use kitchen and co-packer (a facility that makes products for other businesses) run by the Franklin County Community Development Corporation. It marked its 25th year in 2026 and has worked with roughly 800 businesses, including farmers turning produce into products such as sauces that can be sold long after harvest. A University of Massachusetts Amherst project funded by Northeast SARE (the USDA's Sustainable Agriculture Research and Education program) ran freezing trials at the center. It found that frozen retail vegetables made with similar equipment are unlikely to be profitable for a single farm, and that the approach suits larger operations or groups of farms better. Spinach was especially costly because of hand labor.

In both regions the cooler, freezer or processing line is shared, and the business that runs it is set up to serve many farms at once.

Food safety basics, stated carefully

Rules depend on what you make, how much you sell and where. Here is a general orientation, not legal advice:

- **FSMA Produce Safety Rule.** Applies to many farms that grow, harvest, pack or hold raw produce. FDA publishes inflation-adjusted cutoffs. For 2025, FDA lists farms with average annual produce sales of about $35,000 or less as not covered, and a qualified exemption for some farms with average annual food sales under about $705,000 that sell mostly to qualified end users. These numbers change each year, so check FDA's current figures.
- **Processing changes the category.** Cutting, cooking, freezing or packaging produce into a new product usually moves you from farm rules into food facility rules. Depending on scale, that may include FDA registration and the FSMA Preventive Controls for Human Food rule, or state and local food licensing.
- **Licensed kitchens.** Most products sold beyond cottage food limits must be made in a kitchen inspected and licensed by a state or local agency. Cottage food laws vary widely by state.
- **Special categories.** Acidified foods such as many pickles and salsas, low-acid canned foods, juice, meat and poultry each have additional federal or state requirements and training.
- **Traceability.** FDA's Food Traceability Rule adds recordkeeping for certain listed foods. Its compliance date has been extended, so check the current date and whether your products are on the list.

In a shared facility, decide early who holds the licenses, who handles sanitation and records, and how each user's product stays separate and traceable.

PUT THESE IN WRITING BEFORE YOU SHARE A COOLER OR KITCHEN

Who holds each license and registration, and who is named on inspections

Who cleans, sanitizes and keeps the records, and on what schedule

How space and time are booked, especially in peak harvest weeks

How each user's product is labeled, separated and traced

How costs are split: rent, power, repairs, insurance and testing

What happens if equipment fails and product is lost

6. Energy, byproducts and the connected system

Cold chain uses energy and processing makes byproducts. Seeing both as inputs to other systems is the core idea behind connected regenerative design.

Energy

Refrigeration is often the largest electrical load on a produce farm or hub. Ways to reduce it:

- Better insulation and door management (strip curtains, fast-closing doors, a small anteroom).
- Precooling outside the storage room so the room only holds temperature.
- Shading condensers and keeping coils clean.
- Matching on-site solar to cooling load, with thermal or battery storage for off-sun hours.

Byproducts

The US EPA's *Wasted Food Scale* ranks pathways for food that is not eaten by people. Prevention and donation rank highest. Feeding animals, composting and anaerobic digestion all rank above landfill and incineration.

- **Animal feed.** Clean produce trimmings and culls are often fed to livestock. Rules apply, especially for anything containing meat. The federal Swine Health Protection Act regulates feeding food waste to pigs, and many states restrict it further. Food facilities that send byproducts to animal feed may also fall under FDA animal food rules.
- **Compost.** On-farm or community composting turns trimmings into soil amendment that can return to the same fields. State rules may apply above certain volumes.
- **Anaerobic digestion.** Digesters turn wet organic material into biogas and a nutrient-rich digestate. They usually need steady, large volumes, so they often make more sense at a regional scale or shared with dairies and municipal programs.

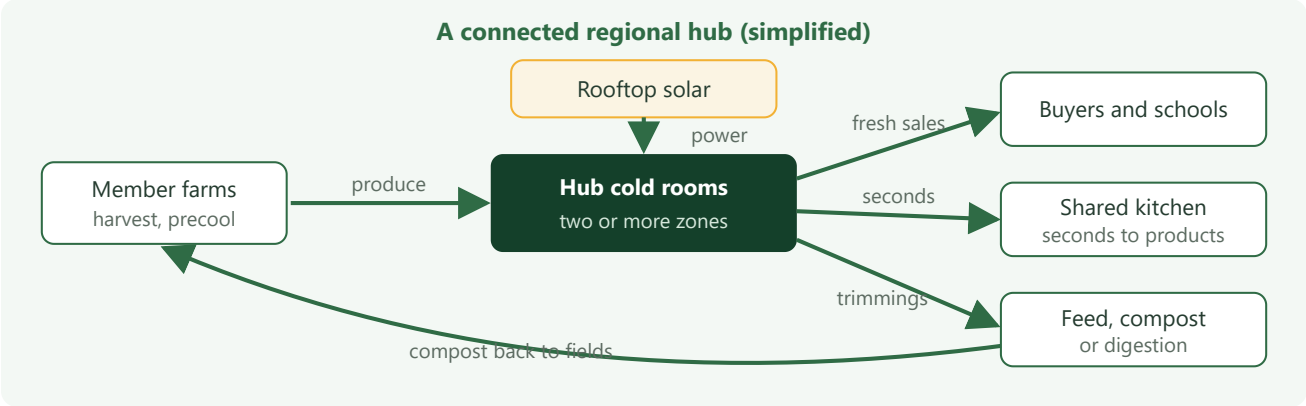
How it fits together

Use this table to start one conversation per stream:

Stream	Who could use it	First question to ask
Edible seconds	Food banks, a shared kitchen	Who can pick up, and how often?
Clean trimmings and culls	Nearby livestock farms	Does any of it contain or touch meat? (Swine Health Protection Act and state rules)
Trimmings for compost	Your farm, a community compost site	How much per week, and does that volume need a state permit?
Steady wet organics	A dairy or municipal digester	Do they accept outside food waste, and in what amounts?
Midday solar power	Your cold rooms	Does cooling load peak in sun hours, or is storage needed?

Rows are ordered roughly as the EPA *Wasted Food Scale* ranks them, from feeding people down to digestion.

Picture a regional hub with rooftop solar powering its cold rooms, a shared kitchen turning surplus into frozen products, and trimmings going to livestock or a compost site that supplies growers. Improvements in one system lower costs or losses in another.



Each arrow is a place where one part of the system lowers the cost or loss of another.



Trimmings and culls can go to compost or digestion instead of the landfill.

> **COMMON MISTAKE: SENDING MIXED KITCHEN SCRAPS TO A PIG FARM**
>
> Clean field culls and vegetable trimmings are one thing. Scraps from a shared kitchen that contain meat, or have touched meat during preparation, count as "garbage" under the federal Swine Health Protection Act. USDA APHIS says garbage may be fed to pigs only by a licensed feeder who cooks it to 212°F for 30 minutes and cools it first, and each state decides whether to allow garbage feeding at all. APHIS's April 2024 fact sheet lists 25 states that prohibit it, including New York, Oregon, Vermont and Iowa. Keep produce-only bins separate and labeled, and check with your State Animal Health Official before any feed arrangement starts.

7. Funding and support programs

Programs change often, so check current program pages and deadlines.

- **USDA Rural Development** has programs for value-added production, such as the Value-Added Producer Grant program, and for renewable energy and energy efficiency on farms and rural small businesses.
- **USDA Agricultural Marketing Service** runs local and regional food programs, such as those under the Local Agriculture Market Program, which have supported food hubs and aggregation.
- **USDA Farm Service Agency** has offered low-interest loans for farm storage facilities, which have included cold storage for fruits and vegetables.
- **State departments of agriculture** often administer specialty crop block grants and state-funded infrastructure programs.
- **SARE** (Sustainable Agriculture Research and Education) offers farmer and community grants for testing practical ideas.
- **Extension and produce safety programs** provide free technical help, workshops and food safety training.

Matching a project to a program, in five steps (status checked November 2026):

1. Name what you are paying for: a building or cooler, equipment, energy upgrades, planning, or marketing.
2. For storage owned by a farm, ask your FSA county office about a Farm Storage Facility Loan. FSA lists cold storage facilities as eligible, with loans up to $500,000 and a microloan option up to $50,000.
3. For energy upgrades, contact your state Rural Development energy coordinator. USDA REAP is not accepting grant applications now; guaranteed loan applications are still accepted.
4. For group or hub projects, read the last round's rules and watch for the next one: the FY2026 Value-Added Producer Grant window closed April 22, 2026, and the FY2026 Local Agriculture

Market Program window closed June 5, 2026.

5. In Canada, check your provincial ministry's current Sustainable Canadian Agricultural Partnership programs (see below).

> **CANADIAN READERS**
>
> In Canada, the Safe Food for Canadians Regulations, administered by the Canadian Food Inspection Agency (CFIA), apply to food businesses that import, export or sell across provincial borders. Food sold only within a province is generally licensed and inspected under provincial rules. For funding, the federal-provincial Sustainable Canadian Agricultural Partnership (2023 to 2028) supports many cost-share programs delivered by provincial agriculture ministries; check your province's current program list.



Step-by-step: planning your cold chain upgrade

1. **Measure your losses.** For one season, track culls, unharvested product and returns by crop and reason.
2. **List your crops and volumes.** Use the worksheet below. Note peak harvest days, not just totals.
3. **Group crops by temperature and humidity needs.** Decide how many zones you need.
4. **Map the path from field to buyer.** Find where product sits warm, waits or gets handled roughly.
5. **Choose a precooling method** that fits your highest-value, most perishable crops.
6. **Size storage** for peak volume plus room for air to move around stacks.
7. **Check rules early.** Talk to your state produce safety program, health department and local building office.

8. **Plan power.** Estimate electrical needs, check your service capacity and consider solar and thermal storage.
9. **Plan for byproducts.** Decide where culls and trimmings will go.
10. **Look at sharing.** Ask neighbors, hubs or co-ops about a shared cooler, kitchen or truck.
11. **Research funding** that matches your project and timeline.
12. **Install monitoring.** Use temperature data loggers in every zone and review them weekly.

Weekly cold room check sheet

Post one copy per zone on the cooler door. Record the lowest and highest readings each day from your data logger or thermometer.

Zone and set point	Mon low / high	Tue	Wed	Thu	Fri	Sat	Sun	Action taken
	/							
	/							
	/							

Season loss log

Use this for step 1. A season of entries shows which crops and which steps lose the most, so you know where cooling or processing will pay back first.

Date	Crop	Pounds or units lost	Reason (cull, left in field, returned, spoiled in storage)	Notes

AT SEASON'S END, READ YOUR LOG WITH THESE QUESTIONS

Which three crops lost the most pounds, and in which weeks?

Is most loss "left in field"? Look at labor, timing and outlets for seconds (Sections 1 and 5).

Is most loss "spoiled in storage"? Compare your weekly check sheets with the Section 2 targets for temperature, humidity and ethylene.

Do returns cluster after hot days or long deliveries? Look at precooling and handling (Section 4).

Are culls mostly cosmetic? Price a processing outlet or a food bank pickup.

Which single fix would cover the largest share of lost pounds? Start there.

Worksheet: crop, volume and site planning

Crop and temperature table

Crop	Peak weekly volume (lbs or units)	Harvest months	Target temperature (°F)	Target humidity (%)	Chilling-sensitive? (Y/N)	Ethylene producer or sensitive?	Precooling method

Site checklist

- ☐ Number of temperature zones needed: _____
- ☐ Available floor space (sq ft): _____
- ☐ Shaded, level spot close to the packing area: _____
- ☐ Electrical service available (amps/voltage): _____
- ☐ Backup plan for power outages: _____
- ☐ Water source tested for post-harvest use (date): _____
- ☐ Drainage for wash and hydrocooler water: _____
- ☐ Space for solar panels (sq ft, orientation): _____
- ☐ Temperature data loggers per zone: _____
- ☐ Destination for culls and trimmings: _____
- ☐ Rules checked (produce safety, health, building): _____
- ☐ Potential partners for sharing: _____
- ☐ Funding programs to research: _____

EXAMPLE: THREE ROWS FILLED IN FROM THIS REPORT'S TABLES

- **Strawberries:** 32 to 34°F, 90 to 95% RH. Not chilling-sensitive. Very short life, so cool within hours. Precool with forced air; skip hydrocooling and icing, because wetting harms berries.
- **Sweet corn:** 32 to 34°F, 95 to 98% RH. Not chilling-sensitive. Hydrocool or package-ice it quickly, since its sugars turn to starch when warm.
- **Tomatoes:** 50 to 60°F or warmer, 85 to 95% RH. Chilling-sensitive. Ripe fruit gives off ethylene, so store apart from greens and carrots. Precool with forced air.

Peak weekly volume and harvest months come from your own records; the season loss log is a good place to start.

Common mistakes to avoid

- **Building storage without a precooling plan.** A storage room filled with warm product will struggle and lose quality.
- **One temperature for everything.** Chilling-sensitive crops get damaged in a cold room set for greens.
- **Ignoring humidity.** Dry air wilts greens and shrivels roots, even at the right temperature.
- **Undersizing for peak harvest.** Plan for your busiest week, not your average week.
- **Mixing ethylene producers and sensitive crops.** Store apples and tomatoes apart from greens and carrots.
- **No temperature monitoring.** A unit that fails over a weekend can cost a harvest.
- **Starting processing before checking licensing.** Rules depend on the product and the market.

Glossary

- **Cold chain:** The unbroken series of cooled steps from harvest to the buyer.
- **Field heat:** Heat that produce carries from the field at harvest.
- **Precooling:** Rapidly removing field heat before storage or shipping.
- **Respiration:** The living process in harvested produce that uses up sugars and water and gives off heat.
- **Chilling injury:** Damage to some crops stored below their safe temperature, often around 50°F.
- **Relative humidity (RH):** The amount of moisture in the air compared to the most it can hold at that temperature.
- **Ethylene:** A natural gas some fruits give off that speeds ripening and aging in sensitive crops.
- **Seven-eighths cooling time:** The time needed to remove seven-eighths of the temperature difference between product and cooling medium.
- **Food hub:** An organization that aggregates, distributes and markets source-identified food from local and regional producers.
- **Anaerobic digestion:** A process in which microbes break down organic material without oxygen, producing biogas and digestate.

Next steps

If you want to see how cold chain links with energy, water and waste systems, visit The Integrated System page at fundingregeneration.earth/integrated-system/. For more free guides and reading lists, see fundingregeneration.earth/resources/.

Who to call first, by question

If your question is about...	Start with	See
Wash or hydrocooler water, or whether the Produce Safety Rule covers you	State produce safety program or extension office	Sections 4 and 5
Licensing a processed product or a shared kitchen	State or local health department or food licensing agency	Section 5
A loan for a farm-owned cooler	FSA county office (Farm Storage Facility Loan)	Section 7
Solar or energy efficiency upgrades	State Rural Development energy coordinator	Section 7
Feeding culls or trimmings to livestock	State Animal Health Official	Section 6
Canadian food rules or cost-share programs	CFIA, or your provincial agriculture ministry	Section 7

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Disclaimer

This report is educational information only. It is not legal, food-safety certification or engineering advice. Rules, thresholds and funding programs change, and they vary by state and locality. Check current requirements with the relevant agencies, and work with qualified professionals before building, processing or selling food.

YOUR NEXT THREE MOVES

1. **This week:** start a simple loss log by crop and reason (culls, left in field, returns).
2. **This month:** fill in the worksheet and group your crops into temperature and humidity zones.
3. **This season:** call your state produce safety program and one nearby hub or co-op about sharing cooling or processing.