



HARVEST CREW 《HANDBOOK》

HARVEST-TO-SALE
HANDLING CONCEPTS THAT
WILL HELP YOU PREPARE
FOR ON-THE-JOB
TRAINING.

«ACKNOWLEDGEMENTS»

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◆ Pack ◆ SHED RULES

《HARVEST CREW HANDBOOK》

Good harvest-to-sale handling techniques are important to us as farmers because we work hard to grow, care for, and harvest quality produce. We want to ensure our fruits and vegetables stay at their peak quality as long as possible, thereby satisfying our customers and sustaining our businesses.

Your job is to get produce from the field to the customer at its highest quality and safely, while working efficiently and carefully and using good handling practices at each step: harvest, cleaning and cooling, sorting and grading, packing, storage, transport, and display.

High-quality, clean produce with a long shelf-life will increase sales for the farm and create jobs for workers like you year after year. Doing your job well contributes to the overall success of the farm.

This manual will help you understand the following post-harvest handling concepts:

- A satisfied customer's expectations
- A plant's respiration process
- How to handle different respiration rates, ethylene producers, and cold-sensitive crops
- Food safety and the 4 W's: Workers, Waste, Water, Wildlife
- Sorting, grading and culling
- Training Checklist & Employee Agreement

Not everything in this handbook applies to every farm. Your on-the-job training will teach you handling procedures specific to your farm.

TRAINING CHECKLIST & EMPLOYEE AGREEMENT

At the end of this handbook, you will find a checklist and a place for your signature. Review the checklist, ask your farm manager about topics you don't fully understand, and sign it when you're comfortable with the concepts in this handbook.

«A SATISFIED CUSTOMER»

Customers expect produce to be at its peak quality, be clean, and have a long shelf life.

When customers receive our produce, they form an immediate opinion on quality. After a customer stores their produce at home, their opinion can change.

“Shelf life” is the length of time that produce can be displayed for sale and still look and taste good to the customer, or the length of time produce is in good shape in a customer's refrigerator.

A short shelf-life looks like wilted, slimy, or dried out greens; green beans turning brown and soggy; or damp potatoes. Customers will appreciate having produce that is still in good shape after a week or so.

If your farm can sell produce that stays good for a long time, customers will be happy and the farm will earn a good reputation.

If our customer – the wholesale buyer, co-op, restaurant or CSA customer – receives low quality product, they likely won't buy from the farm again.

Meeting or exceeding customer expectations can be done consistently with good harvest-to-sale handling practices.

To understand why these practices are so important, read the next section about respiration.



◆◆ Pack ◆◆ SHEED RULES

A PLANT'S «RESPIRATION PROCESS»

THE PROBLEM

Vegetables & fruits begin to deteriorate the minute you pick them. This process is called “respiration.” The picked fruit or vegetable gradually uses up the sugars, fats, proteins and water stored in its cells and creates heat in the process. The loss of these stored food reserves through respiration results in decreased food value, loss of flavor, and loss of saleable weight.

High respirators deteriorate the fastest. High respirators include:

- Asparagus
- Broccoli
- Scallions
- Leafy greens (kale, lettuce, spinach, cilantro)
- Peas
- Berries
- Sweet corn
- Roots with green tops

THE SOLUTION

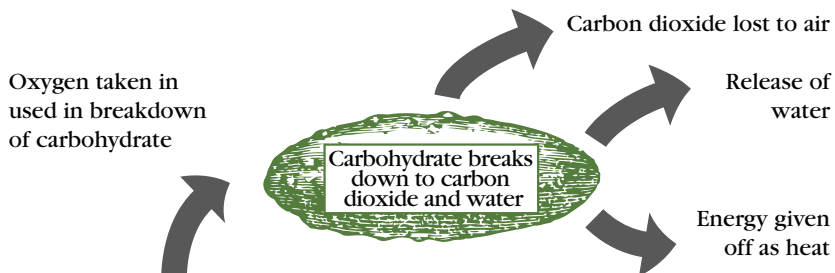
Slow deterioration as quickly as possible.

HERE'S HOW

In the field:

- Harvest at the coolest time of day, usually in the morning, before the sun heats up the plant.
- Create shade for the product.

RESPIRATION IN HARVESTED PRODUCE



Oxygen is released from plant to air

Sunlight falling on leaves provides energy for carbohydrate production

Carbohydrates (starch and sugar) are formed from carbon dioxide and water, accumulate in all plant parts

Carbon dioxide from air enters leaves

Water in

PHOTOSYNTHESIS IN GROWING PLANT

Adapted from: Food and Agriculture Organization

- Prevent moisture loss by harvesting into a covered bin.
- Handle produce gently and as infrequently as possible. Produce should be seen and not heard.

In the pack shed:

- Cool high respirators quickly by removing the field heat (e.g., cooling in water or ice - also known as ‘hydrocooling’).
- Prevent moisture loss by packing into a waxed box or cover with plastic.
- Store cold in the cooler.
- Pack produce to minimize physical damage.
- Avoid produce sweating (i.e., avoid changing the temperature of stored produce from cold to warm to cold, etc.)
- Avoid harvesting overripe produce or produce with skin breaks, bruises, spots, evidence of rotting, or decay.

THE RESULT

Slowing deterioration as quickly as possible reduces:

- Spoilage
- Aging due to ripening or softening
- Texture and color changes
- Moisture loss and wilting
- Undesirable growth, such as sprouting of potatoes.

If cared for properly, fruits and vegetables will look better, have greater nutritional value, better flavor, greater saleable weight, and have a longer shelf life for your end customer.

HOW TO HANDLE DIFFERENT RESPIRATION RATES, COLD-SENSITIVE CROPS, AND ETHYLENE PRODUCERS

MODERATE AND LOW RESPIRATION RATES

While high respirators must be handled with extra care, some other crops with moderate and low respiration rates require special handling, too.

Fungal disease-prone crops such as green beans, zucchini, and tomatoes should be harvested when dry.

Low respirators such as cabbage are less sensitive and can be harvested almost any time in normal harvest conditions.

CHILLING INJURY

Many vegetables and fruits store best at cold temperatures just above freezing, but cold-sensitive crops are injured by low temperatures and will store best at 45 to 55 degrees F.

Damage to cold-sensitive crops may occur in a short time if temperatures are far below 45 degrees, but some crops can withstand temperatures a few degrees into the danger zone for a longer time.

These crops are cold-sensitive and will show signs of chilling injury if stored at too cold of a temperature for too long:

- Tomatoes, squash, peppers, basil, cucumbers, eggplants, pumpkins, okra, and sweet potatoes will decay quickly if over-chilled.
- Snap beans, muskmelons, and watermelons are less sensitive but still susceptible to cold temperatures.

These crops may look okay when removed from low temperature storage, but after a few days of warmer room temperatures, chilling symptoms appear:

- Internal discoloration
- Failure to ripen
- Pitting or other skin blemishes

EHTYLENE PRODUCTION & EXPOSURE

Ethylene is a natural gas given off by ripening fruit. Sometimes it causes wanted ripening (e.g., tomatoes, bananas), while in other situations it causes damage or premature decay (e.g., greens will turn yellow if stored in the same cooler as apples). Avoid storing fruit in the same spaces as vegetables.

notes: _____



◆◆ Pack ◆◆ SHED RULES

HARVEST ORDER FOR COMMON UPPER MIDWEST 《FRUITS & VEGETABLES》

COOL OF THE DAY

LEAFY GREENS

(SALAD MIX, SPINACH, KALE,
CHARD, CILANTRO, PARSLEY,
OREGANO)

ROOT CROPS

(WITH GREEN TOPS LEFT ON)

BROCCOLI

SNAP PEAS

ASPARAGUS

SCALLIONS

CHIVES

BRUSSELS SPROUTS

BOK CHOI

BERRIES

CELERY

CAULIFLOWER

KOHLRABI

FENNEL

SWEET CORN

WHEN DRY

ZUCCHINI

CUCUMBERS

WATERMELON

CANTELOUPE

TOMATOES

PEPPERS

EGGPLANT

SNAP BEANS

BASIL

ANYTIME

CABBAGE

POTATOES

SWEET POTATOES

ONIONS

RHUBARB

WINTER SQUASH

PUMPKINS

ROOT CROPS

(WITH GREEN TOPS REMOVED)



.. Pack .. SHED RULES

WHERE AND HOW SHOULD I STORE IT?

IN THE COOLER

PREVENT MOISTURE LOSS

Leafy greens (kale, lettuce, spinach, cilantro)

Roots with green tops

Scallions

Peas

Asparagus

Broccoli

Berries

Sweet corn

LESS SENSITIVE TO MOISTURE LOSS

Apples

Bulk roots (no green tops)

Cabbage

Celery

Garlic and Onions (once cured)

Potatoes

SHORT-TERM STORAGE IN COOLER

Cucumbers

Green Beans

Cantaloupe (when ripe)

Peppers

IN A COOL PLACE IN THE PACK SHED

NOT IN THE COOLER

Basil

Melons

Eggplant

Okra

Summer Squash/Zucchini

Seed Garlic

Tomatoes

Winter Squash

Remember: Some fruits give off a natural gas (ethylene) that increases ripening, so store them as far as possible from vegetables to reduce unwanted exposure.



◆◆ Pack ◆◆ SHEP RULES

FOOD SAFETY & THE FOUR W'S:

《WORKERS, WASTE, WATER, WILDLIFE》

THE PROBLEM

We handle food that people eat, which means we must make sure the food our customers buy is not going to make them sick. A foodborne illness or disease outbreak traced back to a farm can make a farm go out of business.

Contamination from these and other pathogens (disease-causing organisms) has been found on fresh fruits and vegetables:

- E. coli
- Salmonella
- Cryptosporidium
- Hepatitis A
- Cyclospora
- Listeria

Contamination can occur on the farm in many ways:

- Manure touching produce, either directly or indirectly
- Workers with dirty hands touching the produce
- Produce packed or transported in dirty containers
- Splashing of water from the floor or ground onto produce
- Via dirty or polluted hydrocooling or wash water, or by pathogens on the surface of vegetables that spread to others in the same wash tank.

Food can also be contaminated by things other than pathogens:

- **Non-food items** like rocks or pieces of plastic, glass or metal, can get in with the food (for example, from an unnoticed broken light bulb).
- **Chemicals** like cleaners or gasoline, either from spills or from residue on equipment can also contaminate food.

THE SOLUTION

Workers on the farm must take responsibility to produce safe food.

Remember that even though you might feel healthy, the food you're handling is often eaten raw and the folks eating it might have a weakened immune system. If you have a young niece or nephew, an elderly grandparent, or a friend with cancer, think of them as you follow good handling practices.

Understand the four Ws, which are high-priority areas for food safety:

- **Workers:** Workers can contaminate produce at any point from harvest to packing. In every task you do on the farm, you are responsible for food safety for your customers. Imagine customers standing behind you and ask yourself, what will make them satisfied with your work?
- **Water:** Almost everything you do on the farm involves water. Paying attention to water cleanliness and appropriate use of water is important. We must use potable (drinkable) water for post-harvest processes, handwashing, and irrigation - do not use surface water (water from ditches, ponds or streams.) Water itself can harbor pathogens like E. coli or Listeria.
- **Waste:** All farms must observe proper time delays between raw manure application and crop harvest. Talk to your farm manager about appropriate timing for applying manure, if applicable to your job.
- **Wildlife:** Crops with droppings on or near them, or chewing damage, should not be harvested. If you see animal droppings on harvest equipment or in the pack shed, take the time to wash and sanitize the equipment properly.

THE RESULT

With exceptional food safety practices, we can help protect our customers, our farm's reputation, and our business sustainability.

HERE'S HOW

- High risk crops are those eaten raw or those which come into close contact with the soil such as leafy greens like spinach and melons like canteloupe. Pay special attention to handle them safely.
- Wash your hands for 20 seconds with soap when you get to the farm, before working in the pack shed, and before handling produce.
- Wash your hands after going into the bathroom, blowing your nose,

coughing, sneezing, touching your face, eating, touching an animal or animal waste, or handling garbage; before and after treating a cut or wound; or whenever they're dirty.

- Do not wash your hands in produce wash tanks. Use the handwashing sink.
- Use single-use towels for drying so germs don't spread through a reusable towel.
- Use the designated restroom.
- Do not work when you are ill. Sick employees can get other employees and customers sick, especially if you have the flu or diarrhea.
- Maintain a clean work environment. To avoid creating an environment favored by rodents and flies, compost and food waste should be removed from the pack shed daily. Floors should be hosed down or swept to remove all food waste before the end of each work day.
- Don't harvest or handle any crops that have been contaminated with manure, bird poop, etc.
- If you cut yourself, mark the area or produce that might have blood on it, tell your farm manager, and use the first aid kit.
- Cover your hair when possible.
- Use clean tools and boots (clean them to ensure there is no manure on them) when harvesting or in the pack shed. Change your footwear before or after livestock chores.
- Do not apply manure on fields where a produce crop is growing. Talk to your farm manager if you have questions.

notes: _____



◆◆ Pack ◆◆ SHEP RULES

SORTING, GRADING & CULLING

THE PROBLEM

For most produce, quality does not improve after harvest. It can only be maintained.

Spoiled produce can cause problems. One bad tomato packed with others can ruin more and more the longer the rotten one stays with the rest of the bunch. Injured, decayed or otherwise defective pieces of produce are often referred to as unmarketable “culls.”

Our customers can buy from many different farms, stores and distributors, so if our farm wants to keep their business, we must meet their expectations.

GRADING

Farms follow grading standards from the USDA that define what Grade A should look like in terms of condition, size, cleanness, maturity, shape, uniformity, temperature, and the way the box is packed. Your farm manager will help you understand what grading requirements to follow.

Wholesale customers expect uniformity in size and shape. They usually want Grade A, although some institutional markets may accept less uniformity if their emphasis is on flavor or niche product, or if they're using the product for processing.

Retail customers often keep back stock for days or weeks and refill displays as customers shop. Maximum shelf life is needed because it could be a week or longer before the store's customer is seeing the product.

Restaurants, co-op delis, or farm-to-school programs sometimes accept more variance in grading – they will usually be processing the product and don't require uniformity. On the other hand, some restaurants might demand the highest quality only.

THE SOLUTION

Start with the highest quality product by harvesting at the right time – both time of day and ripeness of the crop.

Examples:

- **Broccoli** should be harvested when its beads are tight and no yellowing has started.
- **Watermelons** and **winter squash** won't ripen further after being picked. It is important to pick these crops at maturity for optimum flavor and texture.
- **Tomatoes** continue to ripen after harvest and are categorized into "harvest stages." Appropriate harvest stages may be different depending on the buyer for the product. See the "Tomato Example" on the next page.

Sorting, grading and culling produce is something you should do throughout the harvest and post-harvest process to ensure quality product, and it is based on buyer preference.

During harvest, washing and packing: 1) Watch for skin breaks, bruises, spots, rots, decay, and other deterioration, as well as contamination (e.g., manure); 2) Notice if produce is out of grade.

Either discard the out-of-grade produce to the compost pile if it's not saleable, or grade it as a second or third. Crops for storage should show none of these blemishes. Bruises and other damage not only affect appearance, but they also increase the rate of decay.

THE RESULT

Sorting, grading and culling leads to a consistent, high quality product with a long shelf-life, and gives the farm a reputation for good product.

If produce is sorted and graded at each step as it moves through the field and pack shed, the farm will save the energy of handling, cooling, packing and transporting unsaleable produce.

HERE'S HOW

TOMATO EXAMPLE

Sort for Grade A tomatoes, cull those with open cracks, and sort tomatoes suitable for canning customers.

Grade A typically means all packed in the box are the same variety, medium size, and none are misshapen or show cracks or blemishes.

MATURITY STAGES FOR DIFFERENT CUSTOMERS:

- Full ripe, ready to eat: For a local market, immediate sale or processing to paste or dried forms.
- Partially ripe (pink or turning): For transport to regional or distant markets.
- Breaker stage (10 days from full red at 64 degrees F): For short term storage or long distance shipping (not below 50 degrees!).

Label each tray or box of tomatoes when placed into storage in the pack shed with the “date in” and other important info like “Grade A” or “canners”.

Put only top quality tomatoes in CSA boxes.

notes: _____

TRAINING CHECKLIST

Check off each concept as you work through training. If you are unsure about any items, be sure to get clarification from your farm manager before checking the box.

- ☐ A satisfied customer's expectations
- ☐ A plant's respiration process
- ☐ How to handle different respiration rates, cold-sensitive crops, and ethylene producers
- ☐ Food safety and the 4 W's: Workers, Waste, Water, Wildlife
- ☐ Sorting, grading and culling

EMPLOYEE AGREEMENT

I, _____ have been trained on these topics and am comfortable with my understanding related to each of them.

Signature: _____ Date: _____

notes: _____

notes: _____



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