



AGRONOMIC SPOTLIGHT

Sweet Corn Harvest: Quality and Safety

- » Sweet corn is highly perishable and requires prompt cooling after harvest for maximum quality and marketable shelf-life.
- » Harvesting is done by hand or with mechanical harvesting equipment, which can pose many potential dangers to workers.
- » Attention to food safety and sanitation is important throughout the growing season, and especially during harvest and post-harvest handling procedures.

Maintaining Quality at Harvest

Sweet corn quality is dependent on sugar content and volatile flavor compounds. The sugars in the kernels will begin to convert to starch after the ear is harvested or after the milk stage (R3) if left on the plant, which will reduce the sweetness and tenderness of the product. The higher the temperature, the more rapidly this process occurs. To avoid losses in quality, it is critical to cool the sweet corn as promptly as possible after harvest and to maintain the cold temperature through to market. For maximum quality, sweet corn should be cooled to around 32° F within an hour after harvest. Under optimal harvest and post-harvest conditions, the maximum shelf-life of sweet corn is only about 5 to 7 days. The longer the sweet corn remains at above optimal temperatures, the shorter the marketable shelf-life. Some producers choose to harvest in the cooler early morning hours or at night to avoid the heat of the day.

Other factors that can affect the quality of sweet corn include insect and disease damage and damage from hail, drought or other environmental conditions. After harvest, plowing and destroying crop debris as soon as possible can help to avoid pest overwintering and breeding sites.

Sweet corn is ready for harvest when the silks are dried and turning brown, but before the outer leaves of the husk lose their green color and start to shed. The ears should feel firm and the kernels should have a milky or creamy appearance when squeezed. Harvesting too late will result in reduced quality.

Hand Harvest

In some states, the majority of sweet corn is harvested by hand because this method allows for better selection of marketable ears. Sorting for quality in the field also decreases the time required for culling in the packinghouse, which means the product can move to the cooling step more quickly. Harvested ears can be placed on conveyors in the field to be transported to a packing facility, or packed directly in the field on harvest aids for an even quicker and more efficient packing process.



Figure 1. Sweet corn ready for harvest.

Mechanical Harvest

Sweet corn is mechanically harvested by self propelled or tractor pulled harvesters. With mechanical harvest, the part of the stalk that contains the ears is cut by the harvester and the ears are subsequently removed either by the harvest machinery or by hand. Culling and packing occurs later in the packinghouse.

Culling Criteria

When assessing the marketability of sweet corn, kernel rows should appear uniform and individual kernels should look full and plump with a high percent milk. The shuck should adequately cover the entire ear with no separated leaves. Ears should be inspected for live insects, damage from insects and diseases, and defects such as discoloration, decay and handling injury. The shank should be trimmed short at or immediately after harvest to reduce moisture loss and flag leaves may be trimmed for visual appeal.

Harvest Equipment Safety

Harvesting equipment can pose many potential dangers to the operator and others in close proximity. Weather conditions can pose potential dangers to all personnel involved in harvest. Listed below are tips for promoting safety at harvest.

Proper Clothing

- » Wear high-visibility, close-fitting clothing to reduce the chance of being caught or pulled in by moving machinery.

Sweet Corn Harvest: Quality and Safety (cont.)

- » Workers who are hand-harvesting should wear long sleeves and long pants for protection from the abrasive leaves, insect bites and sun burn.
- » Secure loose hair and do not wear jewelry as these can be grabbed by moving parts.
- » Wear hard shoes or boots with slip resistant treads; steel-toed boots are recommended.

Equipment Maintenance

- » Thoroughly inspect and test farm equipment before use.
- » Lubricate and maintain harvesting equipment on a regular basis.
- » Refer to the owner's manuals when maintenance or repairs are necessary.
- » After maintenance has been completed, ensure all guards are in place prior to operating the equipment.

Field Safety

- » If a problem with mechanical equipment is encountered in the field, terminate all power sources and ensure the machinery is in park or neutral with the parking brake engaged before working on it.
- » Wait a few minutes after turning off farm equipment to make sure all parts have completely stopped moving before working on it.
- » Keep hands out of pinch points. Numerous farmers have lost their hands while trying to free jammed chains, belts, etc.
- » Never attempt to pull a stalk free from an operating harvester, you cannot let go of a stalk in time if the machine clears itself.
- » Be careful of accessories that can be raised and lowered to ensure they don't drop unexpectedly while being serviced or transported.
- » As with any field operation, stay hydrated to maintain awareness and take breaks to limit fatigue.

Food Safety and Sanitation

General precautions to avoid contamination with potential sources of human pathogens should be practiced throughout the growing season. Good sanitation practices are just as important during harvest, packing and shipping. Below are some guidelines that can help reduce the potential for contamination.

Maintaining Food Safety during Harvest

- » When hand-harvesting, field workers should not harvest or

handle culls to prevent the spread of infectious agents. Culls should be left in the field and removed by a separate work crew.

- » Follow all OSHA regulations on requirements for toilets and hand cleaning stations in the field.
- » Clean and sanitize all field equipment such as: harvesting aids, picking containers, knives, brushes, buckets, etc. and avoid placing tools in direct contact with the soil. Plastic containers are better to use than wood because they are easier to clean and sanitize.
- » All workers should wear rubber or latex gloves and sanitize them often at chlorine sanitizing dip stations.
- » Sick workers should wear protective gear that shields the product from exposure or not be allowed to touch fresh produce.
- » Keep containers to be used for packing and shipping clean and separated from dirty ones. Don't allow them to touch the ground or any unsanitary surface where they can become contaminated.

Maintaining Sanitation Post-Harvest

- » Water used for cooling purposes should be potable and continuously treated with a sanitizer such as chlorine to prevent the introduction of pathogens.
- » Cold-storage facilities should be cleaned and sanitized on a regular basis. Even in cool conditions, the human pathogen *Listeria monocytogenes* can survive and multiply when moisture is present. Condensation and drips from refrigeration units should be minimized.
- » Transport vehicles such as refrigerated trailers should also be inspected, cleaned and sanitized regularly.

Sources:

Hurst, B. and MacLean, D. 2011. Commercial sweet corn production in Georgia. Bulletin 1388. University of Georgia Extension. www.caes.uga.edu.
 Mossler, M.A. 2014. Crop profile for sweet corn in Florida. EDIS Publication CIR1233. University of Florida IFAS Extension. <http://edis.ifas.ufl.edu/pi034>.
 Rains, G.C. and Sumner, P.E. 2012. Corn production safety and health for farmers. Bulletin 1333. University of Georgia Extension. <http://extension.uga.edu>.
 Web sources verified 7/8/15.

For additional agronomic information, please contact your local seed representative. Developed in partnership with Technology, Development & Agronomy by Monsanto.

Individual results may vary, and performance may vary from location to location and from year to year. The information provided in this article may not be an indicator of results you may obtain as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible. **ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS.** The recommendations in this article are based upon information obtained from the cited sources and should be used as a quick reference for information about growing sweet corn. The content of this article should not be substituted for the professional opinion of a producer, grower, agronomist, pathologist and similar professional dealing with this specific crop. SEMINIS DOES NOT WARRANT THE ACCURACY OF ANY INFORMATION OR TECHNICAL ADVICE PROVIDED HEREIN AND DISCLAIMS ALL LIABILITY FOR ANY CLAIM INVOLVING SUCH INFORMATION OR ADVICE. 150706102645 071715CAM

Postharvest Sweet Corn Handling and Storage

- » Sweet corn is highly perishable and requires constant cooling from harvest to consumer to deliver a high quality product.
- » There are several cooling methods available depending on operation size and transport time including: hydrocooling, package icing, vacuum cooling, and forced air cooling.
- » Continued temperature maintenance after initial cooling is critical to help maintain sweet corn quality.

Sweet corn has a high rate of respiration, which can lead to the conversion of sugar into starch, reducing quality. To prevent loss of sweetness, it is important to cool sweet corn quickly after harvest.¹ Sweet corn products containing the supersweet, or *sh2*, gene can reduce the conversion of sugar into starch. This allows *sh2* sweet corn to be stored 2-9 days longer than traditional sweet corn products.^{2,3,8}

Postharvest Cooling

Hydrocooling. This sweet corn cooling process is the most common method used for small and large operations. Sweet corn is either showered with or immersed in cold water (32 to 38° F) to cool down sweet corn after harvest. Complete immersion may be able to cool sweet corn faster and more efficiently than showering. Hydrocooling helps to reduce crop water loss, but costs may be higher as containers must tolerate exposure to water.¹ Sweet corn may be hydrocooled by bulk or in crates. Bulk hydrocooling can cool sweet corn from 86 to 41° F in about 60 minutes, whereas crated sweet corn takes about 80 minutes for the same cooling.² Sweet corn packed in wirebound crates can prevent cooled water from contacting the cobs, reducing cooling potential, and loading crates onto pallets prior to hydrocooling can further prevent cooling.⁴ It is important to monitor cob temperatures during hydrocooling to establish a minimum temperature of 50° F. Top icing, or adding a 2- to 4-inch layer of crushed ice on top of loaded pallets⁵, is recommended after hydrocooling to maintain cooling.³

Package icing. For local and direct shipments, sweet corn containers can be filled with crushed ice as sweet corn is being packaged and transported. As the ice melts, cooling decreases, so additional ice may be needed to maintain cooled temperature. The amount of ice required for initial cooling equals 20-30% of the weight of the sweet corn being cooled. This method of cooling is effective, but the additional weight from the ice can increase shipping costs.¹

Vacuum cooling. Sweet corn is placed into air-tight containers and wetted and top-iced prior to steam-jet pumps removing air from the containers. This removal of air causes moisture to evaporate, reducing the temperature of the sweet corn. This method can reduce the temperature of large loads from 86 to 41° F in about 30 minutes. This cooling method is quick, but can be expensive.^{1,2}



Figure 1. Sweet corn being harvested, packed, and loaded on a truck to be cooled.

Forced air cooling. Small operations can cool sweet corn by forced air cooling. This method is not as efficient as other methods and involves more cooling time, resulting in infrequency of use.¹

Although decay is not typically a major problem, it is recommended to use ice made from potable water, and use chlorinated (at 50 ppm, or pH 7) potable water when hydrocooling, to help reduce the risk of pathogenic organisms causing decay in sweet corn.³

Storage Facility

To maintain quality, sweet corn should be stored immediately after postharvest cooling and for the shortest time possible, with a maximum of 2 weeks including transit time. Sweet corn is not sensitive to chilling; and as such, it should be stored as cool as possible (32 to 34° F) without freezing. High humidity (95% to 98% relative humidity) helps reduce moisture loss and kernel denting.^{1,2,6}

Refrigerated Transport

To continue to help maintain quality, transport sweet corn in a refrigerated truck and package with additional ice to help reduce moisture loss and maintain temperature.¹ The recommended temperature during transit is 32° F, with a relative humidity between 95 to 98 percent.⁷



800 N Lindbergh Blvd
St. Louis, MO 63167

First Class Mail
U.S. Postage Paid
Monmouth, IL
Permit No. 60

**Do you find these newsletters
valuable to your operation?**

If so, visit our website:

<http://www.seminis-us.com/email-sign-up/>
to sign-up to stay connected with us.

Once enrolled, you will have full access to our various agronomic, technical and product resources. We look forward to continuing to provide you with valuable resources that help to improve your vegetable production operations throughout the year.

Please visit us at www.seminis-us.com for more information about our company and current product offerings.

Postharvest Sweet Corn Handling and Storage (cont.)

There are two main containers used for packaging and shipping sweet corn: wirebound crates and fiberboard boxes. Wirebound crates can be shipped by loading them in rows, allowing space between crates for top icing. Crates may also be loaded with no space between them for the first two or three layers, followed by offset rows and wooden strips between layers to help keep the shipment from shifting. A large amount of top ice may then be applied, eventually melting and cooling the lower layers. Fiberboard boxes resistant to moisture can be stacked directly on top of each other to allow top ice to melt and flow between boxes. Loads that will not have top ice should be loaded so that adequate airflow exists between crates or boxes.⁷

Sources:

¹ Li, C., and Hawkins, G. 2011. Postharvest cooling. The University of Georgia Cooperative Extension. Commercial Sweet Corn Production in Georgia. Bulletin 1388. <http://www.caes.uga.edu/>. ² Brecht, J.K. 2014. Sweet corn. United States Department of Agriculture Agricultural Research Service. The Commercial Storage of Fruits, Vegetables, and Florist and Nursery Stocks. HB-66. <http://www.ba.ars.usda.gov/>. ³ Global Chain Alliance. 2008. Corn, sweet. World Food Logistics Organization. <http://www.gcca.org/>. ⁴ Kemble, J.M. and Dangler, J.M. 2001. Commercial sweet corn handling. Alabama Cooperative Extension System. ANR-584. <http://www.aces.edu/>. ⁵ Boyette, M.D. and Estes, E.A. Crushed and liquid ice cooling. North Carolina Cooperative Extension Service. AG-414-5. <http://www.bae.ncsu.edu/>. ⁶ Suslow, T.V. and Cantwell, M. 2013. Corn, sweet: Recommendations for maintaining postharvest quality. University of California Postharvest Technology Center. <http://postharvest.ucdavis.edu/>. ⁷ Ashby, B.H. 2008. Protecting perishable foods during transport by truck. United States Department of Agriculture. <http://www.ams.usda.gov/>. ⁸ Hochmuth, G.J. et. al. 1999. Sweet corn production in Florida. University of Florida. HS737. Web sources verified 07/13/15.

For additional agronomic information, please contact your local seed representative. Developed in partnership with Technology, Development & Agronomy by Monsanto.

Individual results may vary, and performance may vary from location to location and from year to year. The information provided in this article may not be an indicator of results you may obtain as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible. **ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS.** The recommendations in this article are based upon information obtained from the cited sources and should be used as a quick reference for information about growing sweet corn. The content of this article should not be substituted for the professional opinion of a producer, grower, agronomist, pathologist and similar professional dealing with this specific crop. SEMINIS DOES NOT WARRANT THE ACCURACY OF ANY INFORMATION OR TECHNICAL ADVICE PROVIDED HEREIN AND DISCLAIMS ALL LIABILITY FOR ANY CLAIM INVOLVING SUCH INFORMATION OR ADVICE. 150707082141 071515MEC