

Commercial Sweet Corn Handling

Sweet corn requires timely post-harvest handling to maintain product quality for distant markets. The storage life of sweet corn is reduced in several ways. The loss of water from the ear results in denting of kernels and loss of green color in the leaves of the husk. With time, the kernel wall also toughens, and sugar is converted to starch. These changes in quality are accelerated at high temperatures compared to the conversion at 32 degrees F, the recommended storage temperature. By following the procedures for handling sweet corn described in this publication, growers and shippers can maintain a quality product. These procedures are also applicable to corn intended for sale in local markets if the product is not intended for immediate consumption.

Obtaining Quality

Varieties

The quality of sweet corn is usually described in terms of its sugar content and kernel color. Detailed descriptions of these characteristics are given in Extension publication ANR-583, "Commercial Sweet Corn Production."

Sweet corn varieties may be grouped into two categories depending upon sugar content and other quality characteristics.

Traditional. Traditional or standard sweet corn varieties (su-1), containing 3 to 5 percent sugar at harvest, have been the choice of many Alabama growers over the years.

High Sugar. Sugar-enhanced (se) and shrunken-2 (sh-2) varieties produce kernels with 7 to 10 percent sugar content. Conversion of sugar to starch, and the decrease in sweetness associated with this change, is as rapid in sugar-enhanced varieties as it is in standard varieties. Conversion in shrunken-2 varieties, however, is at a slower rate than in standard and sugar-enhanced varieties.

Pollination and Kernel Color

The pollen of one type of sweet corn can pollinate the ears of any other type of corn, and the intended kernel color and sugar content may not

develop if accidental pollination occurs. Therefore, it is best to isolate each type of sweet corn from other types by distance or by time of planting.

Cultural Practices

Sweet corn is a warm-season crop. The new supersweet varieties are especially sensitive to environmental conditions. To provide conditions for good stand establishment, prepare a fine seedbed (to promote good soil-seed contact) and plant seeds at 1½ to 2 inches deep (rather than 3 to 4 inches for the standard sweet corn varieties). A general description of the skills and resources required for the production of quality vegetables can be found in Extension publication ANR-525, "The Production and Marketing of Quality Vegetables." For detailed descriptions of good production practices, see ANR-583, "Commercial Sweet Corn Production," and the Results of Vegetable Variety Trials in the most recent edition of the Alabama Agricultural Experiment Station Fruit and Vegetable Research Update. For information on pest control methods, especially the control of corn earworms and fall armyworms, see ANR-2, "Commercial Vegetable Insect, Disease, Nematode, and Weed Control," or ANR-500, *Alabama Pesticide Handbook*.

Maintaining Quality

Harvesting

The optimum time of harvest occurs when silks have just turned brown. At that time, ear size should be uniform, and husks should appear fresh. Mature kernels are sweet, milky, plump, and well developed. Markets require quality corn to be free of insect damage and mechanical injury. Varieties bred to produce one ear per stalk favor uniformity at harvest.

The method of harvest varies according to the availability of labor, equipment, and the requirements of the market. If a mechanical harvester is used, additional grading is required to remove cull ears and trash. Machines are available that trim shanks.

Grading

It is desirable to have ears with dark green, attractive husks that have flag leaves (the leaf that branches toward the tip of the ear). Tight coverage by the husks at the tip, which keeps the ear worms out, is also a characteristic of a quality product. The kernels should be filled to the tip of the ear and arranged in straight rows. Failure of the kernels to fill at the base of the ear is referred to as butt-end blanking. This problem results when some varieties are grown under drought conditions. Ideally, ears should be cylindrical and the same length.

Commercial sweet corn for fresh markets is graded as U.S. Fancy, U.S. No. 1, and U.S. No. 2. "Unclassified" is not a grade; this designation refers to ears that have not been graded. Summaries of the grade standards are found below. The most obvious characteristic of quality sweet corn is the length of the cob. Standards are described in detail in Lennartson (1954), available from the Alabama Department of Agriculture and Industry, and in a publication in preparation by Dangler and Welch.

U.S. Fancy. U.S. Fancy consists of ears that are well trimmed and well developed. They must also be free from smut, decay, rust or other disease, discoloration, and damage from any source including worms or other insects, birds, or machines. The corn must have similar varietal characteristics. Cobs must be fairly well filled with plump and milky kernels and well covered by fresh husks. The length of each cob should not be less than 6 inches, and the ears should not be clipped to obtain this length.

U.S. No. 1. U.S. No. 1 also consists of ears of similar varietal characteristics that are free from the defects described for U.S. Fancy corn. Ears may be clipped but should not be less than 5 inches long.

U.S. No. 2. U.S. No. 2 consists of ears of similar varietal characteristics that are fairly well trimmed and fairly well developed. They must be free from smut, decay, and serious defects, as described for U.S. Fancy. Cobs should not be poorly filled, and kernels should be plump, milky, and fairly well covered with fresh husks. Unless otherwise specified, the cob length, clipped or unclipped, should not be less than 4 inches long.

Packing

Sweet corn is usually packed in wirebound crates containing $4\frac{1}{2}$ to 5 dozen ears, weighing about 42 pounds. Although retailers purchase corn by the crate, corn is sold by the ear. Therefore, it is very important to consistently fill crates with the same number of ears.

Waxed fiberboard cartons of the same volume as wirebound crates are also used to pack sweet corn. The main advantage of the carton compared to the crate is the carton's relative capacity to retain slush, or liquid ice. On the other hand, because of their open sides, wirebound crates are ideal for hydrocooling with cold water.

Removal of Field Heat

The field heat, determined by measuring the cob core temperature at harvest, should be removed within a few hours of harvest. Cooling the corn before placing it in cold storage conditions should remove at least three-quarters of the difference between the initial cob temperature and the final storage temperature of 32 degrees F. Failure to achieve this reduction in field heat by precooling usually results in poor quality sweet corn because it is difficult to bring the temperature of the cobs down to 32 degrees F, the recommended storage temperature, by simply placing crates of corn in cold storage.

Precooling Methods. Because sweet corn is usually packaged in wirebound crates and because the crop is susceptible to water loss, hydrocooling (running cold water through palletized crates) has been the most common precooling method. Vacuum cooling of sweet corn, along with the application of water to reduce the drying effect of the procedure, is also an efficient method of precooling. Slush or liquid icing is another method for removing field heat. In this procedure, a mixture of ice and water is pumped into crates with the added effect of the residual ice that continues the cooling process.

Factors Affecting the Efficiency of Hydrocooling. The time the sweet corn spends in the hydrocooler, the water temperature, and the degree to which the cold water maintains contact with the surfaces of the ears affect the efficiency of the precooling procedure.

The duration of the precooling operation should be sufficient to permit the removal of the heat. If the operator pushes the product through the hydrocooler before the time required to lower the temperature in the core of the cob, poor quality sweet corn will probably result because the remaining field heat will promote the conversion of sugar to starch.

To obtain maximum cooling efficiency, the water of the hydrocooler should be maintained at 32 degrees F. To ensure proper operation of the facility, the water and cob temperatures should be monitored frequently. Adjustments in the time that the crates remain in the hydrocooler may be

necessary because of changes in cob and water temperatures throughout the day.

Hydrocooling corn packed in wirebound crates reduces the degree to which water contacts the cobs. Palletizing crates further reduces the flow of water around the cobs, especially cobs in the center of the crates. The difference in the contact of cold water with packaged sweet corn, compared with the contact that could occur with bulk sweet corn, should be kept in mind when monitoring the operation of a hydrocooler.

Storage Temperature Requirements

Sugar and other flavor components of sweet corn decrease rapidly at room temperature. To prevent these changes and the loss of moisture from kernels through the husk, storage in cool, moist conditions is required. Loss of sugar is about four times as rapid at 50 degrees F than at 32 degrees F. In a single day, about 60 percent of the sugar may be converted to starch at 50 degrees F, whereas only 6 percent is converted at 32 degrees F. Although the conversion of sugar to starch is slower with shrunken-2 sweet corn than standard and sugar-enhanced varieties, cold storage at 32 degrees to 35 degrees F and high humidity (95 to 100 percent) are required to maintain a high sugar content for extended periods of time.

Sweet corn can be stored with cabbage, greens, and Irish potatoes because these commodities also require lower storage temperatures than other vegetables (Gaus, DiCarlo, and Zuroweste 1977). Corn may be adversely affected by storage with muskmelons and tomatoes because these crops produce the gas ethylene.

Product Appearance

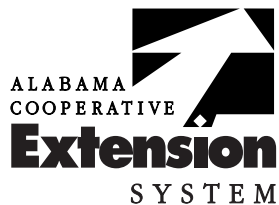
Kernels become dented soon after harvesting if there has been a significant loss of moisture. To maintain a quality product, long shanks and flag leaves, which draw moisture from kernels, should be trimmed and the ears maintained under high relative humidity conditions. A loss of only 2 percent moisture may result in objectionable kernel denting. Precooling followed by top icing during storage and transit aids in maintaining a high relative humidity. A cool, moist environment favors retention of moisture and prevents denting of kernels and drying of the husk.

Nutrition

Compared to most other vegetables, sweet corn has a high carbohydrate content (Gebhardt and Matthews 1981). However, an ear of sweet corn contains only about 90 calories. Sweet corn provides a substantial amount of vitamin A and a moderate amount of vitamin C. Proper handling helps to maximize the nutritional value of the product.

References

- Results of the 1989 Vegetable Variety Trials. 1990. Alabama Agricultural Experiment Station. Auburn University, Ala.
- Dangler, J. M., and F. M. Welch. In preparation. Green Corn Grader's Guide.
- Gaus, E. G., H. DiCarlo and R. Zuroweste. 1977. Vegetable Harvesting And Storage. Agricultural Fact Sheet 56. USDA. Washington, D.C.
- Gebhardt, S. D., and R. H. Matthews. 1981. Nutritive Value of Foods. USDA Human Nutrition Information Service. Home and Garden Bulletin 72. Washington, D.C.
- Lennartson, R. W. 1954. United States Standards for Grades of Green Corn. F.R. Doc. 54-2915. USDA AMS, Washington, D.C. 20402.



ANR-584

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ECP, 2M, **Reprinted July 2001**, ANR-584