SWEET CORN PRODUCTION

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Field corn was grown in North America before 200 B.C. Field corn is produced primarily for animal feed and industrial uses such as ethanol, cooking oil, etc. In contrast, sweet corn is produced for human consumption as either a fresh or processed product. The specific time when *sweet* corn originated cannot be pin-pointed; however, sweet corn was grown by the American Indian and first collected by European settlers in the 1770's. The first variety, Papoon, was acquired from the Iroquois Indians in 1779.

Sweetness Genes – Standard sweet corn is a mutant type of corn that differs from field or dent corn by a mutation at the sugary (*su*) locus. The sweet corn (*su*) mutation causes the endosperm (storage area) of the seed to accumulate about two times more sugar than field corn. Today several hundred sweet corn varieties are available. Recently, a number of new mutants have been used to improve sweet corn eating quality, particularly the sugary enhanced (*se*) and shrunken-2 (sh_2) genes.

The *se* varieties, also called Everlasting Heritage (EH), are well-suited for local market production because they contain more sugars than the normal (*su*) sweet corn and therefore will remain sweet about two to four days after harvest if refrigerated. The *se* varieties can be grown in the same manner as *su* corn. Sugary enhanced hybrids and normal sweet corn varieties do not require isolation from each other.

The shrunken 2 (sh_2) sweet corn, also called supersweet, has two main advantages over the other types: 1) it is at least two to three times sweeter, and 2) the conversion of sugar to starch is negligible, thus this corn type will remain sweet up to 10 days after harvest if cooled properly, then refrigerated. Because of these advantages, sh_2 varieties exclusively should be grown for sales to distant markets. The demand for sh_2 corn is increasing at local markets, also.

The sh_2 sweet corns must be isolated at least 300 ft from all corn types, otherwise the corn will be starchy if cross pollinated. Besides isolation, cross pollination can be prevented by varying planting dates or selecting varieties such that the pollination stage (silking date) does not coincide among corn types. For varieties requiring similar time for development, planting dates for each variety must be more spread apart early than later in the growing season to avoid cross pollination. This is because temperatures are cooler (less heat unit accumulation) in the early versus late spring plantings.

Corn Color – Sweet corn comes in three colors: yellow, white, and bicolor (yellow and white). Cross-pollination of yellow kernel varieties with white kernel varieties will result in production of bicolor corn. Also, if a

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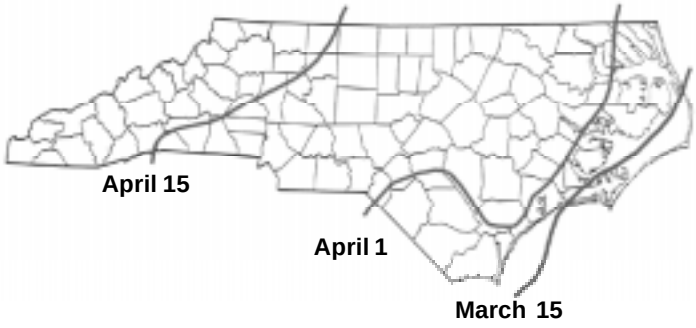
bicolor is cross pollinated with a yellow variety, kernel color will be predominantly yellow. Although there are geographical preferences for certain kernel colors, there is no relationship between color and sweetness.

Variety – Growers should consider making trial plantings to assure a given variety meets their needs and the needs of their customers. As a rule, early varieties are lower in quality than mid-season and late varieties. However, consumers are often willing to accept lower quality in exchange for earliness. Table 1 lists some sweet corn varieties that have grown well in North Carolina under a wide range of environmental conditions.

Planting – Normal (*su*) and sugary enhanced (*se*) sweet corn should not be planted earlier than 7 to 10 days before the average date of the last killing frost (Fig. 1). At least three rows of each variety should be sown at each planting to assure good pollination. Seeding depth should be 1 inch in heavy soils and 1½ inches in light, sandy soils.

Figure 1. Average Date of Last Killing Frost



Seeds of sh_2 varieties are less vigorous than other sweet corn types, which can lead to reduced, uneven stands. Researchers have suggested that the reduced vigor is related to reduced starch reserves for germination, cracked seed coats, and increased sugars which render the seed more susceptible to disease. Several precautions are suggested to help ensure the best possible stand. Seed should be handled carefully, and preferably with a plate-less planter so that seeds will not be damaged. All seed should be treated with insecticide and fungicide (check with seed companies to see if treatment has been applied before purchasing seed). Supersweet seeds should be sown approximately ½ inch shallower than other sweet corn types. Planting of supersweet varieties should be delayed until the soil warms to 60°F.

Spacing – Row spacing may range from 30 to 42 inches apart depending on equipment, with one plant every 8 to 10 inches. Three-ft rows, with 10 inches between seeds, will provide about 17,000 plants per acre. This will require 9 to 10 lb of *su* or *se* corn seed per acre. Supersweet sweet corn seed contains a large quantity of sugar which causes the seed to be crinkled and smaller. Therefore, supersweet sweet corn varieties have a higher seed count (225 seed per lb) than other sweet corn types (150 seed per lb) and will require less seed (5 to 6 lb) to plant an acre.

Obtaining Earliness – Several methods fan be employed to obtain an early harvest of sweet corn. The most obvious method is to choose a variety which is an early maturer. Also, a more vigorous variety will germinate under less-favorable growing conditions.

In addition, seeds can be sown 10 to 20 days earlier using a clear plastic mulch. Photo-degradable mulch (30-day type is recommended; the plastic breaks down slowly after exposure to sunlight) can be used to eliminate the cost of removing mulch at the end of the growing season. When using clear plastic, seed in double rows 14 to 24 inches apart on 5- to 6-ft centers. A Ferris Farm Equipment "Poly-planter" has worked well for planting other vegetables on plastic in North Carolina. Apply herbicide and then cover with clear, 1½ mil, 4-ft-wide plastic. Leave the plastic over the emerged plants approximately 30 days, then cut and remove plastic. Earliness and weed control can also be enhanced by growing corn on black plastic mulch.

Sweet corn is seldom transplanted, but this can be done in special cases to ensure plant stands and early yields. To grow transplants, seed in trays with 1½-inch cells, three weeks before the expected transplanting date. Transplants should be grown and transplanted without experiencing any stress, e.g., water, fertilizer or temperature. Stressed plants will tassel early, and yields will be reduced significantly.

Fertilization – Apply fertilizer according to soil test results. A general recommendation would be to apply a total of 150 to 180 lb of nitrogen, 50 to 60 lb of phosphate (P_2O_5), and 70 to 90 lb potash (K_2O_5 per acre). For early plantings, when cold conditions are often encountered

(60°F), use a "starter" fertilizer (e.g., 10 gal of 11-37-0 or 75 lb of 18-46-0 per acre) for improving seedling vigor, stand establishment and early plant growth is recommended. Fertilizer should be applied in 1 or 2 bands approximately 3 inches to the side and 2 to 3 inches below the seed. Between 50 to 60 lb of actual nitrogen per acre should be applied preplant or at planting, while a sidedress application of 90 to 100 lb should be applied when the plants are 18 to 24 inches tall. For the piedmont and mountains, less phosphate (20 to 25 lb per acre) and potash (40 to 50 lb potash per acre) may be required. The market demands sweet corn with long, green flag leaves and dark green husks. To accomplish this, an adequate supply of nitrogen must be maintained in the soil.

Irrigation – A field with good soil moisture will enhance early, uniform emergence, good growth, and increase yields and improve quality. Irrigation should be provided before the soil becomes dry. Young sweet corn plants have a rather coarse, shallow root system, but as the plant approaches maturity, the root system becomes more fibrous and penetrate to a depth of 3 ft or more. A grower should be prepared to irrigate at least 1 to 1½ inches a week in order to produce high quality sweet corn. The most critical time period to have adequate moisture is during tasselling and silking.

PEST CONTROL

Weed Control – Select a field that does not contain noxious weeds. Crop rotation is important for limiting the build up of troublesome weeds. Shallow cultivation should be used in concert with chemicals for weed control. The crop should remain weed-free during the early stages of plant growth; otherwise, yields might be substantially reduced. Several herbicides are available for weed control. Identify the weeds in each field and select the herbicide which will control those weeds. If double cropping, be sure that crops sensitive to herbicide carryover, particularly atrazine or atrazine-containing products, not be planted.

Insect Control – Sweet corn must be free of worms for shipping or distant markets!! The corn earworm is by far the most difficult insect to control in sweet corn. Eggs are laid on the young silks where they hatch and the larvae feed on the silks and tips of the ears. Commercial plantings require a high-boy sprayer with drop nozzles and high pressure (>200 PSI) to direct the spray at the ear zone. Apply recommended insecticides *(*consult the current *N.C. Agricultural Chemicals Manual)* on young plants as needed until tassel shoots appear. When tassel shoots appear, spray insecticide, then 3 days there-after, followed daily with 5 consecutive applications. Thereafter, sprays will need to be applied at least every 2 to 3 days until harvest. If harvest is after July 1, apply insecticide daily to ensure worm-free ears. For more detailed information on worm management in sweet corn, consult Entomology Insect Note #41, *Corn Worm Management*.

Disease Control- Disease problems tend to be sporadic. Troublesome diseases include smut and rust. Use crop rotation, and avoid sequential planting in adjacent fields to minimize disease. Also, some cultivars are more tolerant or resistant to disease. For example, published reports from Michigan State University Extension have indicated that varieties in this publication (Challenger, Landmark, Zenith, Dazzle, Sweeter Bi-Far, Even Sweeter, Champ, 64Y, Bodacious, Calico Belle, Viva, and Silverado) are more tolerant or resistant to smut.

If a weed, insect or disease problem does occur, consult the current *N.C. Agricultural Chemicals Manual* for pesticide labels or your local county extension office for control recommendations.

Harvesting – As an ear approaches maturity, sugar changes to starch, the hull becomes tougher, and the kernels pass through stages called pre-milk, milk, early dough, and dough. At field temperatures of 60°F, an ear may remain in prime condition for as long as 5 days; at 85°F it might remain in prime condition for only 1 to 2 days. Corn will be ready for harvest approximately 18 to 22 days after silking. As the field nears maturity, a few ears should be examined daily to determine the time for the first picking. Corn is ready for harvest when the ear is full size for the variety, has a tight husk, and has somewhat dried silks. The kernels are fully developed and exude a milky liquid when punctured. Whether harvested by hand or machine, sweet corn should be collected at night or early in the morning, when it is cool. Every effort should be made to keep harvested ears cool and in shaded areas.

Both three-point hitch and self-propelled harvesters are available. Approximate cost for a one-row harvester is between $12,000 and $15,000. On average, a one-row harvester can pick about 10 acres during an 8-hr day. There are one-, two-, and multi-row harvesters. Currently,

Byron (Byron, NY) and Pixall (Clear Lake, WI) are the major manufactures of corn harvesters.

Harvesting machines may produce ears with shorter shanks and less-green husks than hand harvesting. Kernels lose more moisture during storage when long shanks and flags are left on the ears. Closely trimmed ears have less moisture loss.

Yields – The state average yield in 1992 was 195 crates per acre. This average was low primarily due to lack of irrigation. If water requirements are met and other cultural practices optimized, sweet corn yields of about 250 crates or about 12,500 ears per acre, can be expected. Potential yields are 400 crates per acre using a high plant population (24,000 plants per acre) and assuming a crate pack of 60 ears.

Harvest and Handling – Sweet corn loses sweetness and freshness rapidly after harvest, and the rate of loss increases with increasing temperature. Corn harvested early in the morning will be 10 to 20°F cooler than that harvested later in the day. Because sweet corn has a high respiration rate, it produces heat which can cause ears in bulk trailer loads to heat up considerably during delays between picking and precooling. The longer the delay, the greater the heating, conversion of sugar to starch, and subsequent quality loss. Sweet corn must be moved quickly from the field to packing sheds, where it should be rapidly sorted, packed, and cooled. Sweet corn is generally packed in wirebound wooden crates which can hold from 4 to 6 dozen ears, depending on the size of the crate or ears. However, cabbage bags or wax impregnated cartons can be used and typically hold about 60 ears.

Cooling – Sweet corn should be precooled to as close to 32°F as possible, although it is rarely cooled below 40°F in commercial practice. Several methods of cooling sweet corn are available:

Hydrocooling – consists of precooling by either showering the corn or immersing it in cold water. It is the most popular method of precooling. Immersing the corn in cold water is much more efficient than showering the corn. Consult a dealer or engineer to ensure maximum efficiency and sufficient capacity to handle anticipated daily volume of sweet corn.

Package Icing – this is an excellent method of precooling sweet corn that is used for local, direct shipments. In this method, 15 to 25 lb of crushed ice are distributed throughout the container (box or crate) during the packaging process. The amount of ice needed in a package depends on the temperatures of the corn at the time of packing and on the expected length of the marketing period. Typically about 1 lb of ice for 5 lb of sweet corn is sufficient. The main disadvantage is that if shipment to market is delayed, the package is heavy and wet.

Cold Storage – To maintain best quality, place sweet corn in cold storage immediately after precooling; storage can be in a refrigerated truck or room. Temperature is maintained as close to 32°F as possible without freezing the corn, and relative humidity of the air in the cold room at 95% or higher to keep the corn fresh. Move the corn out as soon as possible (more than a few days in cold storage will decrease quality).

Icing in Transit – Sweet corn must also be kept cold in transit. The best method consists of blowing finely crushed ice over the top and through the corn crates as trucks are loaded. This method of icing keeps temperatures low during transit but provides little or no additional cooling. The refrigerated truck only maintains the temperature of the already cooled corn. It is not meant to be used as a substitute for precooling. It is key to remember that for maximum quality and value, sweet corn must be continuously and properly refrigerated from harvest until it reaches the consumer.

For further reading/information:

Boyette, M.D., L.G. Wilson and E.A. Estes. 1990. *Postharvest Cooling and Handling of Sweet Corn*. The North Carolina Cooperative Extension Service AG-413-4.

College of Agriculture and Life Sciences. 1995. *The 1995 North Carolina Agricultural Chemicals Manual*. North Carolina State Univ., Raleigh.

Ritchie, S.W., J.J. Hanway, and G.O. Benson. 1986. *How a Crop Plan Develops*. Iowa State University of Science and Technology, Cooperative Extension Service. Ames, IA. Special Report No. 48.

Sorensen, K.A. 1994. *Corn Worm Management*. Entomology Insect Note #41 (revised).

Talbot, M.T., S.A. Sargent, and J.K. Brecht. 1991. *Cooling Florida Sweet Corn*. Florida Extension Service. Circ. 941.

Table 1. Recommended Cultivars for North Carolina.

Cultivar (Season)	Sweetness Gene	Source
WHITE		
Early (70 to 77 days)		
Platinum Lady	se	1,3,4,10,12
Quick Silver	su	5
Viva	se	2
Mid-Season (78 to 84 days)		
Alpine	se	1,8
Chalice	su	8
Silverado	se	5
Snowbelle	se	2
Late (85 to 95 days)		
Even Sweeter	sh	2
Frontier	sh_2^2	2
Pegasus	sh_2	1,4
Silver Queen	su	1,3,8,9,10
Supersweet 8801	sh_2	1
YELLOW		
Early (60 to 70 days)		
Maple Sweet	se	10
Senaca Horizon	su	1,5,7,12,13
Sundance	su	5
Summerflavor 62	se	1
Mid-season (70 to 80 days)		
Bellringer	su	5
Bodacious	se	1,4,9
YELLOW (continued)		
Mid-season (70 to 80 days) continued		
Challenger	sh_2	2
Crisp N'Sweet 711	sh_2	1,4
2Incredible	se	1,4
Landmark	sh_2	5
Merit	su	2,9,13
Pinnacle	sh_2	5
SSupersweet 7210	sh_2	1,12
Zenith	sh_2	5
Late (80 to 90 days)		
Senaca Chief	su	1,7,10
Sweetie 82	sh_2	1,11
BICOLOR		
Early (70 to 80 days)		
Butter & Sugar	su	9
Top Notch	sh_2	5
Mid-Season (80 to 90 days)		
Calico Belle	se	2
Dazzle	sh_2	2
SSupersweet 8102	sh_2	1
SSupersweet 8502	sh_2	1
Late (90+ days)		
Biqueen	su	1,8,9,12

z Seed Companies: 1=Abbott & Cobb, 2=Asgrow, 3=Ball, 4=Crookham, 5=Harris Moran, 6=Johnny's, 7=Robson, 8=Rogers NK, 9=SeedWay, 10=Stokes, 11=Sunseed, 12=Twilley, 13=Willhite