# SWEET CORN

BY
CHARLES W. MARR
NED TISSERAT

Sweet corn is a warm-season vegetable that is adapted for growing throughout Kansas. The flavor and quality of fresh sweet corn makes this crop a natural for fresh market, pick-your-own, or roadside market operations. However, perishability must be considered before planting. The grower must be sure that an adequate market exists to handle the corn immediately after harvest. This guide discusses several requirements for profitable sweet corn production.

## VARIETIES

Many varieties of sweet corn are available. In choosing a variety, you must consider market demand, quality, disease resistance, season of production, and other factors. Standard yellow-colored varieties have been grown for many years. White sweet corn, as well as bicolor (yellow and white-mixed kernels), are now available. White and bicolor varieties are popular in many local markets.

SWEET CORN VARIETIES LISTED IN GENERAL ORDER OF EARLINESS (NOT IN THE ORDER OF PREFERENCE OR QUALITY)

| *Yellow* | *White* | *Bicolor* |
|---|---|---|
| SU-Ordinary Sweet Corn Types | | |
| Seneca Horizon, Sundance, Merit, IoChief | Spring Crystal, Quicksilver, Silver Queen, Spring Snow (early) | Crossword, Honey and Cream, Sweet Sal, Sweet Sue |
| SH-2-Supersweet Types | | |
| Florida Staysweet, Sweetie 76, Sweetie 82 | Snow White, How Sweet It Is | Top Notch, Diablo, Sweeter Bi Far, Phenomenal, Dazzle |
| SE-Extrasweet Types | | |
| Sweet Dawn, Legend, Bodacious, Incredible, Classic, Miracle Sugar Buns | Pristine, Senecal White Knight, Snowbelle | Senecal Brave, Calico Belle, Gold in Pearl, Medley |

KANSAS STATE UNIVERSITY
AGRICULTURAL EXPERIMENT STATION
AND COOPERATIVE EXTENSION SERVICE

Varieties are available resistant to smut, maize dwarf mosaic and bacterial wilt. Early producing varieties usually produce smaller plants (with smaller ears), so consider planting a small amount of early maturing varieties and follow that with more of a longer season variety which will have a larger plant and correspondingly large ear.

Sweetness types: There have been many developments in recent years with newer varieties of corn that have improved sweetness over standard varieties of corn. Sweetness in corn results from the accumulation of sucrose (table sugar) in the corn kernels, but at warm temperatures, sugars are rapidly lost. Varieties of corn are now available that have more sugar and retain sweetness longer.

SU Sugar or Ordinary sweet corn Types—Sweet corn differs from field corn by a single genetic factor (gene) called the sugary or SU gene. These types of corn have been known for many decades. The seed is more shriveled than field corn and will germinate fairly well in cooler soil temperatures. The sweetness level is fair but the sugar is lost rapidly after harvest.

SH2 or Supersweet or Shrunken-2 Types—In 1970 at the University of Illinois, an additional genetic factor (gene), named the shrunken-2 gene, was found that resulted in much sweeter sweet corn, nearly twice as sweet—losing sugar more slowly. The varieties in this class are usually referred to as supersweet. As the name implies, the seed is very shrunken and germination in cooler soil or under any adverse conditions is poor. The seed coat of the kernel of these types of corn is fairly thick, giving the kernels a tougher or "crunchy" characteristic. In addition, the kernels do not accumulate water soluble polysaccharides or "liquid starch," giving them a more watery characteristic. Another disadvantage is that if the corn is cross pollinated by any other corn, it loses sugar content, therefore, isolation of 200 to 300 feet is required. Despite these disadvantages, the extremely sweet flavor of these varieties is a unique marketing advantage.

SE or ExtraSweet or Sugary Extender Types—In 1980, again at the University of Illinois, a third gene called the SE or sugary extender gene, was found and is generally known as ExtraSweet. In some ways, this type of corn is somewhere between the SU and SH-2 types. It is sweeter than ordinary sweet corn, the seed coat is tender, and the kernels accumulate "liquid starch." Germination is better in cooler soils so stands are improved and isolation is not required. Most Kansas sweet corn growers are strongly considering the SI types for all-purpose sweet corn production for local market sales.

Many new varieties are being developed each year. Check with your seed supplier and ask for the latest recommendations on a sweetness type, color, and maturity interval corn that you are interested in. The table on page 1 lists some varieties in each sweetness type and color that have done well in K-State variety trial tests and that commercial growers have identified as most productive.

## POLLINATION

Sweet corn is a wind-pollinated crop. Pollination by other types of corn (field corn or popcorn) can reduce the quality. As discussed earlier, several of the "supersweet" types of corn also will require isolation from each other and from other types of sweet corn. Corn pollinates when the tassels shed pollen to the emerged silks. Corn varieties or plantings that do not tassel at the same time will not cross-pollinate.

## SOILS AND FERTILIZER

Corn grows best in deep, fertile soils, but can be grown in most Kansas locations. Corn requires abundant fertilizer for optimum growth, so don't skimp on fertilizer applications. Get a soil test to determine specific nutrient needs. Generally, 100 to 120 pounds of nitrogen per acre are necessary. Apply 30 to 50 pounds at planting time and additional fertilizer as the crop grows, usually when the corn is 8 to 10 feet tall and again at the last cultivation. Additional nitrogen will be necessary in sandy soils or in wet seasons. Use phosphorus or potassium according to soil test recommendations.

Seedbed preparation will vary, depending on individual preference. Sweet corn can be grown in "no-till" or "minimum-till" systems much like field corn. Be alert for weedy areas or places where corn problems have developed in the past. Sandy soils warm up quickly in the spring but require additional quantities of water, which is essential for corn production.

## PLANTING

Quick germination and emergence requires soil temperatures of 60°F or more. At 55°F germination is slow and will occur only with vigorous, standard sweet corns. Extra sweet types should not be attempted in cold soils for early planting: One week before the average frost date in your area is about as early as you want to gamble. Usual planting dates are from mid-April to mid-May in most of eastern and central Kansas.

A continuous supply of sweet corn requires sequential plantings. You will find the first planting to be slow to emerge, whereas later plantings will come up much quicker. The best method of staggering your plantings is to wait until the previous crop is l to 2 inches tall before planting the next crop. It is questionable whether corn planted in July will produce a crop before frost. Furthermore, yields are normally lower and disease and insect pests more severe.

One of the most difficult factors to determine is plant population. Varieties differ in their vigor and plant size. Generally, earlier varieties are smaller, so greater plant populations are suggested than for more vigorous, mid-season varieties. Field germination rates in sweet corn may be low, depending on variety and growing conditions. Most growers allow for a 75 to 80 percent field germination rate under good conditions. Optimum yields are generally recorded at 2l,000 to 22,000 plants per acre or approximately 8 inches between plants in 38-inch rows. For planting early or under adverse conditions, be sure to allow for plenty of seed. If a poor stand results, consider replanting. Corn should not be “overplanted” or skip-planted to fill in missing plants since these later plants will never be productive. Usually 10 to 12 pounds of seed are needed per acre. Most seed companies offer seed counts and planting rate suggestions for their varieties.

## IRRIGATION

Many varieties of sweet corn have a more limited root system than field corn and watering will need to be more carefully monitored. Corn requires a great deal of water for optimum growth. The plant requirement for water is critical during early ear development and ear fill. As the corn plant grows, its root system deepens and will pick up deeper-placed water. Yields are influenced the most by deficiencies of water as the plant is beginning to tassel. Several irrigation water formulas based on climatic factors, soil type and stage of growth have been developed for field corn production. These may be used as guidelines, remembering that sweet corn is usually earlier to mature and, since the corn is harvested at an earlier stage, water requirements will be less.

## WEED CONTROL

Weeds can compete with corn, causing reductions in yield. Care in choosing fields free of problem weeds is a first step in a weed management program. Seedbed preparation can reduce weed population, and cultivation is easy to accomplish with conventional farm equipment. Several excellent herbicide choices exist for use in sweet corn production. Many field corn herbicides can be used on sweet corn. (Refer to *Weed Control in Vegetable Crops;* North Central Regional Publication)

Herbicide choices and the weeds they combat include:

Sutan Plus (grasses, nutsedge);

Atrazine (grasses, broadleaf)—apply before the crop emerges and do not use where sensitive crops are to be grown the next year;

Dual (grasses, broadleaf)—apply after planting;

Bladex (annuals)—do not use on sandy soil or less than 2 percent OM;

Lasso (broadleaf, grasses)—some nutsedge suppression may occur;

Lasso and Atrazine—reduce Atrazine residue;

Post-Emerge Basagran (broadleaf, grasses, nutsedge)—apply when corn is 6 to 8 inches tall. Split application of Basagran may improve control. Consult label for additional Basagran tank mix combinations.

## HARVEST

Quality of fresh sweet corn is dependent on harvest at the ideal stage of maturity, rapid cooling to retain sugar content, and delivery to the market as soon as possible. Corn can be harvested by hand

or by mechanical corn harvester. Mechanical harvesters come in one-row or two-row models. Probably l0 acres or more of corn would be necessary to support a mechanical harvester.

Sweet corn should be harvested in the "milk" stage—when the kernels spurt a milky juice when punctured. Over-mature corn will have a doughy, starchy kernel content. At the harvest peak, the silks of corn are usually brown, the ear dark green and filled to the tip. Most commercial varieties will produce ears that mature nearly all at once—only a week or less will separate the maturity of the entire crop. Mechanical harvesting of corn destroys the stalk, so only one harvest is obtained. However, with uniformity of maturity, the majority of the ears can be picked in a single harvest.

Firmly grasp the ear, then give it a twist and a downward snap to remove it. In pick-your-own operations, a harvest demonstration may be necessary to lessen damage to stalks. Corn is usually sold by the count—a dozen ears. For roadside or pick-your-own, corn may be handled in bulk. Local or wholesale market corn is usually packed in cartons or sacks holding 5-dozen ears. Some markets may require trimming of the base of the ear (shank). Check with your market for suggestions or preparation.

Corn is usually harvested at one of the hottest times of the year. Pick in the early morning when the corn has less "field heat" and can be cooled more easily. Get the corn into as cool a storage area as possible, as soon as possible. Most commercial, wholesale producers hydro-cool corn by streams of ice water flowing over the cartons. Small-scale producers may use cold water from a sprinkler on a hose in a similar fashion. Display corn in a cool or shady spot until sold. Advertisements to sell corn as soon as it is harvested are the best means of ensuring quality.

## DISEASES

### Seedrot and Damping Off

*Incitants:* Fungi *Pythium* sp., *Rhizoctonia* sp., *Diplodia maydis*

*Symptoms:* Seedrots and damping-off can be serious after planting, especially during springs when the soil remains cool and wet. Cracked or damaged seeds often are rotted before they germinate. If infection occurs after germination, the seedlings may be destroyed before or after emergence (pre- and post-emergence damping-off). Those infected plants that do survive typically are less vigorous and productive than non-infected plants.

Sweet corn is very susceptible to seed rotting and damping-off, in part because the seed possesses a very thin pericarp. The effects of seedrot or damping-off may be noticed first as skips or areas of poor germination in the field. Seeds removed from these areas typically appear dark and water-soaked or mushy. Blighted seedlings that survive turn yellow and may wilt.

The effects of damping-off may easily be confused with injuries sustained from herbicides, fertilizers or some other chemical or mechanical damage. Below-ground portions of the plant should be critically examined for any evidence of lesions, spots or rotting. Generally, injury from some type of chemical is more uniform in the field, but there are exceptions.

*Control:* One of the most important aspects in the control of damping-off is to make sure the seed is of high quality. Avoid planting seed that contains cracks or is injured in any way. The incidence of damping-off can be further reduced by treating the seed with a fungicide prior to planting. Two of the most common chemicals used are captan and thiram. These chemicals will protect seed from the soil-borne pathogens, but have little effect against the seed-borne fungi. Most commercial seed is pretreated.

Seed should not be planted before soil temperature reaches 55°F or higher. Cold soils delay germination and increase the likelihood of damping-off. Avoid planting the seed too deeply or in poorly-drained areas.

### Common Smut of Corn

I*ncitant:* Fungus *Ustilago maydis*

*Symptoms:* Common smut is considered one of the most serious diseases of sweet corn in Kansas. Young seedlings are most susceptible to fungal infection; the likelihood of infection decreases as the plant matures, although actively growing portions of the plant such as new leaves, axillary buds, and flowers remain susceptible to infection. The most conspicuous symptom of the disease is the production of galls on the leaves,

stems, axillary buds, and ears of the plant. These galls may become quite large, reaching sizes of 4 to 5 inches in diameter. The gall is composed of a mass of black fungal spores encased in a silvery white covering. After the spores mature, the covering becomes brittle and releases the black, sooty, often greasy, spores of the fungus. The disease tends to be more serious during hot, dry weather.

*Control:* Complete control of corn smut is difficult. Many of the newer hybrids of sweet corn have some degree of tolerance to smut; however, in favorable weather with high inoculum levels, this tolerance may be overcome by the pathogen. The corn smut pathogen also shows extreme variability in its pathogenicity and new races of the fungus may appear, making efforts to completely control the disease through resistance difficult. Herbicide and mechanical injury predisposes corn plants to infection, so protect plants against insect infestations and carefully follow herbicide recommendations. Seed treatment will not control common smut, even though all seed should be treated to help prevent damping-off. Sanitation is not practical in large-scale operations but may be of some benefit in small fields or gardens, provided it is practiced over several years. All galls should be removed from the field before they burst and disperse the black spores. Neighbors who also grow corn must follow strict sanitation, too, if this method is to work.

**Maize Dwarf Mosaic Virus**
*Incitant:* Virus

*Symptoms:* Maize Dwarf Mosaic (MDMV) is incited by a virus and is another serious disease of sweet corn. MDMV symptoms vary considerably, even in corn plants of the same hybrid; one plant may show symptoms early in the season, whereas another plant will remain symptom-free until after pollination. A high incidence of diseased plants may be detected in localized centers or spots in the field. These infected spots may appear first along one side or end of a field, particularly if Johnsongrass is in close proximity.

Initial symptoms of MDMV appear in younger leaves as indistinct light- and dark-green mottling between the veins, or as elongated pale blotches with interrupted strips. In susceptible hybrids, the blotches and stripes often merge, giving the plants a pronounced yellow cast.

Plants infected early in the season are generally stunted or dwarfed, with diseased plants about one-half the height of healthy plants. As the diseased plants approach maturity (tasseling), red or reddish-purple spots or streaks may develop in the leaves, particularly the upper leaves. Zinc deficiency, which appears occasionally in Kansas, results in the lower leaves becoming red after first appearing yellow. Corn hybrids differ considerably in the expression of this symptom.

*Control:* The most practical means of control is the use of resistant hybrids and varieties of corn. Many cultivars are now available with resistance or tolerance of MDMV. Johnsongrass serves as the overwinter host for both the virus and the aphid vectors, therefore, efforts should be made to eradicate Johnsongrass around fields of sweet corn. Insecticides may be applied to reduce or eliminate the insect vector, but this will not always give satisfactory control.

**Common Rust**
*Incitant:* Fungus *Puccinia sorghi*

*Symptoms:* Generally, rust causes little damage to sweet corn in Kansas, although severe infections can reduce yields. Small, orange to red pustules form on any above-ground portion of the plant. The pustules tend to be more common on leaves. The circular to elongated pustules are first orange, but may become brownish-black as the plant matures. Chlorosis and blighting of leaves may occur after severe infections. The disease first develops in southern states and progresses northward with the prevailing winds. The disease generally occurs in Kansas after silking and causes little damage. Disease development is favored by cool temperatures (62° to 70°F) and high relative humidity.

*Control:* In most years, rust is not serious enough to warrant fungicide applications; however, the disease may be controlled through the use of fungicide applications at the first sign of the disease. Zineb, mancozeb and chlorothalonil are labeled for the control of corn rust. There also are differences in the susceptibility of various sweet corn hybrids to rust.

**Stewart's Wilt or Bacterial Wilt of Corn**
*Incitant:* Bacterium *Xanthomonas stewartii*

*Symptoms:* The disease is widespread in the eastern United States and can cause significant losses in Kansas. Stewart's wilt is much more severe on sweet corn than on dent corn. Symptoms of the disease appear first on the leaves of young plants. Long plate-green to yellow streaks develop along the leaf veins; these streaks typically have wavy margins and may extend the length of the leaf. The leaf streaking may closely resemble lesions of northern corn leaf blight. In general, northern corn leaf blight lesions are more regular than those in Stewart's wilt. Usually, the streaks turn from pale green to brown. Cavities develop in the vascular tissue of the stalk near the soil line. The vascular bundles of infected plants turn brown and exude yellow masses of bacteria when squeezed. Young plants often are killed by the disease; older plants may produce premature, bleached and dead tassels, or they may be seriously stunted. All infected plants exhibit streaking of the leaves.

The bacterium overwinters in the gut and mouthparts of corn flea beetles. After hibernation, these beetles feed on the young, developing corn plants, depositing the bacterium in the feeding wound. The bacterium may be spread further by feeding of flea beetles on diseased plants. Other insects capable of transmitting the bacterium are the southern corn rootworm (twelve-spotted cucumber beetle), the toothed flea beetle, seedcorn maggot larvae, wheat wireworm and May beetles.

Winter temperatures affect the incidence of the disease the following year. When winters are mild, large numbers of flea beetles survive, resulting in greater prevalence of the disease. When winters are severe, most of the beetles are killed and little disease is expected. A simple equation may be used to determine whether Stewart's wilt is likely to be a problem. If the sum of the sum of the average monthly temperatures for December, January and February exceeds 90°F, then there should be high numbers of flea beetles surviving and a higher incidence of the disease.

*Control:* Stewart's wilt is controlled mainly through the use of resistant varieties. Several hybrids of sweet corn are available with resistance to this disease. The application of insecticides can help to control the insect vector of this disease, and thus reduce its incidence.

## INSECTS

### Major Insect Pests

Corn earworm is the most serious pest of sweet corn in Kansas. Because it is a constant (every year) pest, preventive chemical control is necessary using any of the insecticides listed below. First application should be made when 5 to 10 percent of the ears show young silks emerging. Repeat applications should be made every three to five days until 90 percent of the silks are wilted. In hot weather, applications may need to be made at three-day intervals because of rapid silking-out. Newly emerged silk is not protected from previous insecticide treatments.

European corn borer is an occasional important pest of sweet corn. The same chemical treatments used to control corn earworm can be applied for corn borer control.

Chemical treatments and their waiting intervals before harvest are:

carbaryl (Sevin) (0 days)—80% SP, 2.5 lb / A or 50% WP, 4 lb / A;

diazinon (0 days)—4 EC, l.25 qt / A;

permethrin (1 day)—Pounce 3.2 EC, 4-8 fl oz / A or Ambush 25.6 EC, 6.4 - 12.8 oz / A;

fenvalerate (7 days)—Pydrin 2.4 EC, 5.5 fl oz / A;

methomyl (0 days)—*Lannate l.8 L, 2 pt / A or *Nudrin 1.8 L, 2 pt / A.

esfenvalerate—Asana 1.7 - 3.4 pz / A (1 day)

### Minor Insect Pests

Rootworms, cutworms, flea beetles and armyworms may cause periodic problems. Treatments, when necessary, are as follows.

*Rootworms and other soil insects*
(apply at planting):

- * isophenphos (Amaze 20% G, 6 oz / 1000 ft) 7-inch band; minimum
- * terbufos (Counter 15% G, 8 oz / 1000 ft) 20-inch row spacing

- * fonofos (Dyfonate 20% G, 6 oz / 1000 ft) 20-inch row spacing
- * ethoprop (Mocap 10% G, 12 oz / 1000 ft) 20-inch row spacing
- * phorate (Thimet 20% G, 6 oz / 1000 ft) 20-inch row spacing

*Cutworms*
(treat base of plants when damage seen):

- carbaryl (Sevin 80% SP, 2.5 lb / A)
- trichlorfon (Dylox 4 L, 2 pt / A or Dylox, Proxol 80% SP, 1.25 lb / A)

*Flea beetles*
(transmit Stewart's disease pathogen):

- carbaryl (Sevin 80% SP, 1.875 lb / A or 50% WP, 3 lb / A)

*Armyworms*
(If necessary, treat for armyworms as indicated below):

*Note:* For best results, adequate water is necessary. Use 75 to 100 gallons of water per acre. Spray in early morning to use available dew. Direct nozzle into whorl area. Use a spreader-sticker for better penetration.

- + trichlorfon (Dylox, Proxol, 10 oz / A) or carbaryl (Sevin 50% WP, 1 1/2 lb / A)

* Highly poisonous. Use all safety precautions.
\+ May cause some phytotoxicity to young seedlings.

## RETURNS

Sweet corn can be grown with fewer expenses than many vegetable crops since conventional farm equipment is adapted for corn. An average to good yield of sweet corn is from 1,000 to 1,300 dozen ears per acre. In the last several years prices for corn have ranged from $1.25 to $2 per dozen, depending on the season, quality and market type. A typical crop production budget for sweet corn is in the table, opposite.

Fuel consumption is estimated at 1.5 gallons per hour of tractor time. Oil and lubrication is estimated at 15 percent of fuel cost. Repairs are

### COST-RETURN PROJECTION FOR SWEET CORN PRODUCTION IN KANSAS

| *Variable costs per acre* | *Total* |
|---|---|
| 1. Fertilizer | $ 51.00 |
| 2. Seed | 75.00 |
| 3. Herbicides | 13.00 |
| 4. Insecticides (4 appl.) | 35.00 |
| 5. Fungicides | 00.00 |
| 6. Nematicides | 00.00 |
| 7. Labor | 365.00 |
| 8. Fuel and Oil | 42.52 |
| 9. Repairs | 82.25 |
| 10. Water | 8.00 |
| 11. Utilities | 00.00 |
| 12. Custom Hire | 00.00 |
| 13. Supplies (Cartons) | 175.00 |
| 14. Marketing | 00.00 |
| 15. Other | 00.00 |
| **A. Total variable costs** | $ 846.77 |
| *Fixed costs per acre* | |
| 16. Interest (land, buildings) | 60.00 |
| 17. Taxes (land, buildings) | 10.00 |
| 18. Rent for rented land | 00.00 |
| 19. Depreciation, machinery | 75.00 |
| 20. Interest, machinery | 45.00 |
| 21. Depreciation, buildings | 12.50 |
| 22. Depreciation, irr. equipment | 165.00 |
| 23. Interest, irr. equipment | 99.00 |
| 24. Insurance | 6.63 |
| **B. Total fixed costs** | $473.13 |
| C. Total costs | $1,319.90 |
| D. Yield per acre (doz) | 1,000.00 |
| E. Price per unit (doz) | 1.75 |
| F. Returns per acre | 1,750.00 |
| G. Returns over variable costs | 903.23 |
| H. Returns over total costs | 430.10 |
| I. Variable costs per unit | 00.85 |
| J. Total costs per unit | 1.32 |

estimated at $2.25 per hour of tractor time and $17 per acre for irrigation equipment. Fuel, repairs and taxes for a truck are not included as costs.

Depreciation, interest on investment and insurance for a truck are included as costs.

**Note: Trade names are used to identify chemicals. No endorsements are intended, nor is any criticism implied of similar products not mentioned.**

***About the authors:*** Charles W. Marr is an extension horticulturist, vegetable crops; Ned Tisserat is an extension specialist, plant pathology.

**Kansas State University Agricultural Experiment Station and Cooperative Extension Service**

MF-1106 (Revised) January 1995



File Code: Horticulture & Landscaping—11 AB 2-94-500;1-95—500;10-97—