GROWING SWEET CORN for Market and Manufacture

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Cover Photo—Field of Golden Cross Bantam production by means of four rows of the female parent P39 and every fifth row of the male parent P51.
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Extent of Industry

Sweet corn occupies an important place in the list of vegetables grown for the open market and for manufacture. No information is available regarding the acreage of sweet corn grown in the United States for local marketing to cities or for shipment since this crop does not appear in the statistics of the United States Department of Agriculture in so far as car or truck shipments are concerned. Most of the sweet corn grown in the United States, other than that grown for canning and freezing, is produced largely for local markets. This acreage of sweet corn has been comparatively stable for a number of years. The acreage of sweet corn for processing in the United States in 1948, however, was 17 per cent higher than the 10-year-average of 1935 to 1944. During the latter period the annual mean acreage of sweet corn for manufacture was 405,340 acres, but in 1948 it had increased to 474,400 acres.

Sweet corn in Oregon is grown for canning and freezing, for local marketing, and for carlot shipping. U. S. Department of Agriculture reports indicate that for the 10-year period from 1935 to 1944 the average annual acreage of sweet corn for manufacture in the State was 3,010 acres. In 1949 it was estimated that 11,500 acres were harvested for processing.

In comparison with the national canned corn pack of approximately 33 to 34 million cases, the western pack appears to be of comparatively minor importance; nevertheless, it is of importance in supplying the demand of the Pacific Coast area. The estimated number of cases of sweet corn canned in Oregon in 1929 was 6,250, but in 1947 this number had increased to 757,414 cases.

The sweet corn frozen pack in Oregon-Washington in 1934 was approximately 500,000 pounds. This figure had increased in 1948 to 13,293,000 pounds, which was a little less than one-half of the total frozen sweet corn pack of the United States. Of this amount of slightly over 13,000,000 pounds, 8,801,000 pounds were of cut corn and 4,494,000 pounds of corn-on-the-cob.

This bulletin supersedes Extension Circular 448, a mimeograph circular on sweet corn by the same author.
In recent years an industry of shipping green corn from Oregon to markets outside of the state has been developed. In 1938, 51 carloads were shipped out of Oregon and in 1948, 185 carloads originated from Marion, Malheur, Linn, and Lane counties. The majority of the carloads were shipped in September and the remainder in October.

**Climatic Conditions in Relation to Production**

The sweet corn plant is naturally a warm weather plant during practically its entire growth. The young plants of the first early plantings may be injured by late spring frosts. Growth of the plant, particularly in its early stages, is retarded by cool, wet weather but thrives in sunny, warm days. During the period of ear production, however, high temperatures are not so desirable because the kernels pass rapidly from the early-milk to the dough stage, with corresponding change of sugar into undesirable starch.

There is a popular belief that sweet corn grown and canned near the northern limits of its production is sweeter and of better quality than that canned further south. It has been shown, however, that the actual content of sugar in sweet corn differs comparatively little between that grown in the north and south, but the rapidity with which the sugar changes to starch in the field during the development of the ear—and thus the rapidity with which the sugar is lost after harvesting—is in direct proportion to the temperature prevailing. Because of the lower temperatures which prevail in the northern areas during the growth and harvest time, the rate of kernel development is slower. This results in a product which retains its higher quality for a longer period during the harvest season.

**Soils**

For early production a warm, sandy loam soil is valuable, especially if it is high in humus. The yield and quality of sweet corn during the dry period of the summer will be dependent upon the degree of soil moisture available. Most corn grown for processing, for carlot shipments, and for market is irrigated.

Corn will not grow nor yield well on impoverished land or that which is low in moisture content during the summer. The crop is sometimes planted in a rotation, including a legume and some cultivated crop such as potatoes. Sod land is often undesirable because of the possible presence of wireworms.

A large share of the corn in the Willamette Valley is produced on the river bottom soils and under irrigation. Some nonirrigated
corn occurs throughout the valley but is mainly concentrated on the hill soils in Clackamas and Multnomah counties. Another county having a substantial acreage is Malheur county in the irrigated part of eastern Oregon.

**Fertilizers**

It is evident from the experience of various growers that good yields of sweet corn may be obtained by turning under a green cover crop and supplementing it with some commercial fertilizer. Rotted manure is always useful in providing organic matter and plant food and it can be supplemented, if necessary, by an application of some commercial fertilizer, of which the ratio of nitrogen to phosphoric acid to potash has usually been about 1-3-1 or 1-4-1.

It is generally agreed that phosphate fertilizers are useful in stimulating early rooting and early maturity of the plants. A commercial fertilizer having an analysis of 4-12-4 or 4-16-4 has been used and from 300 to 500 pounds of such materials have been applied per acre, depending upon the manner of application. Ammonium phosphate, 11-48, to which some potash fertilizer may or may not be added, would also be a suitable fertilizer. Some growers have applied 250 pounds of 10-16-8 with additional nitrogen applied once through the irrigation lines.

While there may be some difference in the ratio of these plant nutrients to each other, there will also be variation in the manner in which sweet corn fertilizer is applied. In the earlier period of production of corn practically all of the fertilizer was broadcast, but in recent years applications have been made economically and profitably by placing the material in a band 2½ inches away from the row at the time of seeding.

Because of the vigorous growth and large foliage, hybrid sweet corn varieties demand soil of good fertility. They will not produce well on land that might otherwise support some of the open-pollinated varieties having less vigorous growth.

**Varieties**

Varieties of sweet corn differ in season of maturity, size and shape of ear, color, size and shape of kernels, number of ears per plant, edible quality, and commercial value. The most popular varieties of sweet corn are those having yellow kernels. White kernel varieties which formerly constituted the earliest sweet corn have been displaced in recent years by yellow varieties, varying in season from early to late.
The outstanding progress in improving sweet corn as a vegetable has been made in the last 20 years in the breeding of hybrid sweet corn varieties and strains. These strains have largely displaced previously grown open-pollinated varieties. The seed of a single cross hybrid such as Golden Cross Bantam is produced by the transfer of pollen from one inbred strain to the silks of another inbred. These two inbred lines are obtained by means of self-pollination of each of the inbreds for several generations. An open-pollinated variety, such as Golden Bantam, is one in which the seed is produced by natural cross fertilization in the field, in which case any of the plants in the field may act as a male or female parent.

Hybrid varieties such as Golden Cross Bantam are superior to open-pollinated varieties, particularly for manufacture, in that they yield more heavily and mature more uniformly. Labor costs in harvesting are reduced because of fewer times of going over the field. Most fields of Golden Cross Bantam are now harvested once or at the most twice. There is likewise greater uniformity in all characters of the ear. Open-pollinated varieties are useful in home gardens and in some cases in commercial market gardens where a greater spread in the maturity of the ears is desired.

By far the greatest acreage of sweet corn grown for manufacture is of the variety Golden Cross Bantam (P39 x P51). Despite the introduction of hundreds of other hybrids, this variety still remains the standard by which other hybrids are compared. Most of the corn grown for shipping is likewise of this variety. Other varieties include Seneca Golden, Carmelcross, Ioana, Tendermost, and Aristogold.

**Seed and Planting**

It is important to grow a crop of sweet corn from seed obtained from ears carefully selected for type and production. The new hybrid varieties demonstrate the value of combining desirable and congenial male and female inbred lines.

While there are two general ways of planting sweet corn, namely, the hill and the drill method, most of the seed is now planted by drilling, for in this method the plants are better distributed than in the hill system and are also more evenly spaced in the rows so that the harvesting machine can operate more efficiently than if the corn were in hills.

It is useful to treat sweet corn seed before planting, particularly in case the season is late, cold or wet, or if it is necessary to plant the seed in soil that is unusually moist. Seed treatment will protect the seed during germination and will usually effect a more uniform stand
Golden Cross Bantam sweet corn ears before and after husking.

of plants and thus a greater uniformity of maturity of the crop at harvest time. Semesan Jr. is used at the rate of 1 ounce per 37 pounds of seed or 1 1/4 ounces per bushel.

The average depth of planting sweet corn seed is about two inches. If the seed is planted too deeply the young seedlings may be exhausted before the leaves can start vigorous growth above ground. In view of the variation in size of seed of different varieties, adjustments must be made to the seeder so that the proper stand of plants is obtained.

It is unwise to plant corn seed until danger of frost is about over and the ground has begun to warm up. Early varieties of corn are sometimes planted in late April, particularly for the open market, and planting is continued successively through the spring up to about June 15. Another method of providing successional harvestings for
market is that of planting varieties maturing at varying dates. This is particularly desirable in the case of the market garden, the home garden, or sometimes even where corn is grown for canning and freezing. For sweet corn grown for processing, planting is usually made in May with varieties maturing in from 88 to 110 days from seeding.

**Cultivation and Weed Control**

The prime object of cultivating between rows of corn is to destroy weeds. This may also be of value in keeping the texture of the soil intact and preventing crusting. However, light soils quickly form their own mulch and it is improbable that frequent cultivations will assist in conserving soil moisture. Corn cultivation should never be deep. Preferably, the tools should be those which will cut off weeds and form a light mulch. There is no necessity for cultivating corn if there are no weeds, no rain, and the soil already has a satisfactory mulch.

Sweet corn fields have been chemically treated for weed control. A 300-pound application of Cyanamid has been found to reduce the weed population as well as to provide useful nitrogen to the plants. It has been applied as a pre-emergent material on the same day shortly after planting. The sodium salt of 2,4-D has been used both as a pre-emergent and post-emergent weed control material. When used as a post-emergent, one pound in 20 gallons of water per acre has been used effectively on Golden Cross sweet corn—sprayed at the base of the plants when they are a foot high and applied in such a way that the spray comes in contact with the base of the corn stalk and not on the leaves.

**Suckering**

While it is generally true that the hybrid sweet corn varieties have a tendency to produce more suckers than open-pollinated varieties, it appears that there are no definite advantages in removing suckers, particularly from a commercial and economic standpoint.

**Irrigation**

If sweet corn land can be irrigated, the advantages derived from watering warrant the application of water providing it can be applied economically. Ears will usually mature somewhat earlier and more uniformly and there will be a greater percentage of ears of better grade and quality with fewer nubbins. Most growers in
western Oregon use the sprinkling system and in Oregon Experiment Station Bulletin 465 the irrigation cost per acre was stated to be approximately $19.00. In other areas where the land is more nearly level the furrow method of irrigation is used.

**Insect Pests**

The corn ear worm is sometimes troublesome, particularly in the latter part of the summer. Five per cent DDT dust applied directly to the silks as soon as the first ones show and repeated three times at four-day intervals is effective.

The western eleven-spotted cucumber beetle may also be injurious at times in chewing the silks of the ears. The same dust mentioned above for the ear worm will act as a control of these beetles.

**Harvesting**

Sweet corn rapidly approaches the stage of development for harvesting following the appearance of the silks. Usually this is about 20 to 22 days following silking but the actual time will depend on the variety as well as weather conditions. There is a positive correlation between the temperature prevailing during this time and the rapidity of the growth of the ear in reaching a state of harvesting.

It is desirable to harvest sweet corn when it has its best commercial quality. Quality is closely associated with tenderness and the sugar content of the kernels. During the ripening process the sugar rapidly changes into starch, the kernels passing successively through the pre-milk, early dough, and dough stages. The best canning and freezing stage is between the milk and early dough.

Corn may reach its highest point of sweetness 15 days or so after silking, but it is too immature and has an undesirable lack of body and flavor. If harvested too soon, also, the yield of corn per acre and the amount of canned or frozen corn per ton harvested will be lower compared with the corn which is picked at the stage between the milk and the early dough stage. In the best canning stage the sugar content is from 5 to 6 per cent and the starch 10 to 11 per cent, a ratio of sugar to starch of about .500.

The rapidity with which corn passes through the various stages of development is in direct relation to temperatures prevailing. The higher the temperature during harvesting time, the shorter the period during which the corn is in suitable condition to be harvested. In this respect one can more readily appreciate the uniformity of maturity of sweet corn hybrids.
There are several ways of determining when sweet corn should be harvested. First, the ear will appear plump and well filled to the tip; second, the silks will have turned dark; third, a feel of the ear will indicate the kernel development and designate whether or not it is ready to be picked; fourth, the old time "thumb nail test" consisting of penetrating the kernel with the nail to observe the consistency of the exudate; fifth, by means of recorded readings by the succulometer; sixth, moisture determinations.

There is sometimes a tendency to pick ears too mature rather than too young. Quality should not be sacrificed for fullness of ear or weight. No fine canning or freezing process can make a good corn pack out of an inferior or over-mature raw product. This makes it imperative that the stage of development of the ear be watched very closely. In the market garden and home garden it is possible to go over the planting frequently to harvest the ears in their prime stage, but in growing corn for processing harvesting may be done but once or at the most twice. Uniform maturity of each planting is therefore of prime importance in production of corn for processing, considering the fact that many fields are stripped completely in one picking.

Mechanical sweet-corn harvesters are now operating quite extensively, thus making possible more rapid harvesting than by hand—a decided advantage in case of a warm spell of weather when the corn is ripening quickly.

An important factor in harvesting is the loss of sugar in the corn after picking. The higher the temperatures under which corn is kept until processed or shipped, the more starchy it will become and the greater the loss of sugar. During the first 24 hours after harvesting the loss of sugar at 86°F is twice the loss at 68°F. Likewise, if the corn can be kept at a temperature of approximately 50°F, the loss will be considerably less than at 68°F. It is desirable, therefore, to cool the ears as rapidly as possible after harvesting. A good deal of Oregon corn for shipment has been cooled by being put through a cold water immersion. The crates of packed corn move slowly through a chamber in which they are sprayed with, or immersed in, iced water. The crates then are loaded quickly into the cars and top-iced.

Corn to be processed is canned or frozen as rapidly as possible after harvesting, consistent with the readiness with which it can be put through the factory. Rapid handling is important in processing as is the cooling process prior to car shipments of fresh corn.
Containers, Yields, and Values

Market corn usually is packed in the standard five-dozen wire-bound crate. Processed corn is delivered in bulk to the factory.

The number of ears harvested per acre may vary from 10,000 up to as high as 25,000. Probably an average of several varieties would be between 15,000 and 18,000. Some of the better strains of hybrid sweet corn produce up to 22,000 ears per acre. There is considerable evidence that strains of the same hybrid varieties may vary considerably in production, and this is true at the present time among the various strains of Golden Cross Bantam as well as other hybrids.

In tons per acre, sweet corn yields vary from 2 to 6 tons. Some growers have produced more but such yields are unusual. The United States average yield of sweet corn for processing over a recent 10-year period was 2.32 tons per acre.

Sweet corn ears are now being offered in an individual pre-packaged wrap. In some large scale operations in the country the corn is husked mechanically, cut to definite lengths, cooled, wrapped in transparent paper, and again cooled. Pre-packed corn seems to be meeting with favorable consumer acceptance. Refrigeration to 45° F. or lower is essential during packaging and transportation. The best results in truck shipments have resulted when mechanical units were used to cool the air to a lower temperature than those obtained with ice bunkers.

Sweet corn for processing ordinarily has a value of around $25 per ton. Early market corn may bring 65 cents or so per dozen ears at the early part of the season, with the price dropping rapidly under heavy receipts.

References

1. Oregon Agricultural Experiment Station Bulletin 465, Cost of Producing Sweet Corn in the Willamette Valley, Oregon.
Cooperative Extension Work in Agriculture and Home Economics

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