Beet-Sugar Economics

EDITED BY

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This book is dedicated to H. A. Benning, under whose supervision for the past thirty years the author has developed many of the principles herein set forth.

RECEIVING AND STORAGE OF BEETS*

After the beets are loaded into trucks in the field they are hauled to the nearest receiving station. As the load passes over scales, the gross weight of beets and truck is determined, the load is dumped and the loose dirt, which is removed by screens, is returned to the truck bed. The truck is again weighed. The difference between the total weight of the truck and its load and the weight of the truck and loose dirt is called the gross weight of beets.

At the time the beets are going over the receiving-station belt into a pile or cars, a tare sample is caught. The sample is first weighed and then individual beets are cleaned and properly topped in accordance with the terms of the beet-purchase contract. The cleaned sample is reweighed and the dirt, tops, and leaves which have been removed are calculated as a percentage of the original weight of the sample. The percentage loss in weight on cleaning the sample is called "tare." Central tare laboratories have been established in some areas where as much as is practical of the work of taring is handled mechanically and under close supervision.

The tare is applied as a correction to the gross weight of beets delivered to arrive at the "net weight" of beets delivered. Payment to the grower is based on this net weight of beets.

It is to be noted that tare represents two classes of material: (1) loose leaves, stems, stones, dirt, and trash, and (2) crown or "top tare." In the first class are the materials which have no value to the processor but rather represent additional cost for handling. The crown has some value to the grower as livestock feed or fertilizer and to the processor, as some pulp, molasses, and sugar can be recovered from it.

The purchase contract provides that all small or medium-sized beets shall be topped by cutting off the crown squarely at

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the base of the bottom leaf. In the case of a beet having a diameter of four inches or more the crown is to be trimmed up at a 30° angle from the base of the bottom leaf. In recent years the increasing use of beater toppers, which whip off the beet petioles down to the crown, has required that the taking of top tare be liberalized. Some of the "scalpers" that follow the beaters top large beets rather high and some beets are missed entirely.

The crown or top tare is frequently the subject of controversy between processor and grower. The beet-purchase contract specifies the manner in which the crown is to be removed. If more than the specified portion of the crown is left on the beets when they are topped in the field, this portion is removed from the tare sample and an equivalent deduction is made from the weight of beets on which the grower is paid. However, on all the beets delivered this portion of the crown is carried to the factory and enters the process. The sugar in the crown is associated with a relatively high portion of nonsugars and the cost of recovering the sugar is increased. Under some conditions this sugar may be associated with so much nonsugar that its recovery is uneconomical. Controversy arises as to the point at which the topping should be done to exclude sugar that cannot be recovered economically. The grower frequently takes the position that the processor is getting sugar in the "top tare" for which payment is not made. The processor, on the other hand, maintains that the crown is not an acceptable part of the beet and he refuses to buy it.

Receiving of beets involves two general procedures: (1) the delivery to cars with subsequent immediate transportation to the factory for slicing; and, (2) storage.

Co-ordination of beet shipping schedules is so important, to avoid factory delay and reduce storage losses, that it constitutes a large part of the agricultural superintendent's responsibility.

In current practice growers in the immediate factory vicinity truck their beets directly to the factory without use of rail transportation. These beets are received over large pilers and go into storage in the factory yard. No freight or loading costs are incurred in receiving them. In some areas it has been the practice that such beets be paid for at a premium price per ton. However, since freight charges on beets shipped to factories for processing also vary throughout the supplying territory in general proportion to the length of haul, it is the more common practice to pay a uniform price for all beets within the normal factory area, which takes into account the average freight cost for all beets purchased, regardless of the length of the freight haul. By this method sugar-beet farming is equally remunerative to the grower whether his farm is near to or remote from the factory. The factory should be located with respect to its beet-producing territory so as to result in maximum volume of direct-delivery beets.

At several outside receiving stations, centrally located with respect to large producing districts, large storage grounds and equipment are provided to store the beets in piles. Storage is limited to the piles in the factory yard and to these few outside receiving stations where large volumes are expected.

Where relatively small tonnages are expected at the outside receiving stations, beets are loaded into railroad cars and taken directly to the factory. Bottom-dump cars are used and these beets are dropped directly into a wet hopper and flumed into the factory without rehandling and without storage.

There are, in general, the factory pile, the piles at a few large outside receiving stations, and the direct-delivery beets from small stations. Where the geography of the territory will permit, this is an ideal storage program.

Beets, having once been loaded into railroad cars, should not be piled or rehandled but should be sent direct to the factory for slicing. These direct-delivery beets will keep the factory supplied until all non-piled beets are sliced. It would be desirable to slice from the large piles next, reserving the factory pile until the last so that it would serve as a reserve in case of interruptions to rail shipments. However, conditions of storage require a variation from this practice. Piled beets are examined daily and in some cases temperatures at depth are taken. If spoilage occurs the beets at the "hot spots" are reloaded immediately and shipped to the factory for slicing. Even though no evidence of severe spoilage appears, it has become customary to load out the early piled beets first. These beets have been piled during high-temperature weather. By making the rounds of the piles and each time removing the earliest piled beets only, the lowest temperature beets are left to the last. It may happen that three trips are made to each major pile.

A few reloading units can be moved from one outside pile to another when it becomes advisable to go into these beets. By using such mobile units total investment is decreased and flexibility of reloading for processing reduces storage losses.

Whenever frozen beets are received, regardless of whether it is at the factory, large outside stations, or small outside stations, they are loaded in cars and sliced at the earliest opportunity. If frozen beets are allowed to go into piles they may cause rapid spoilage of the stored beets and bring serious financial loss. Provision must be made at every point at which beets are received to deliver frozen beets directly to the factory for immediate slicing.

Beet-receiving equipment is being improved constantly but currently (1951) the most satisfactory is a piler, consisting of a unit carrying one or two truck platforms, a hopper to receive the beets, and a belt elevator. This unit discharges the beets into a second unit where the beets are screened and elevated to a belt carried on a swinging boom which discharges them onto the pile. A tare house is provided in the second unit. Various types of screens and rolls are used to eliminate dirt and trash from the beets, but Reinks screens are now almost universal because of their greater freedom from clogging. A bank of Reinks screens consists of a series of shafts crosswise to the flow of beets. Rows of semihelical-shaped fingers on the shafts are spaced between the fingers on the adjacent shafts. The rotation of one or more shafts is reversed to slow down the travel of beets over the screens. The fingers were formerly made of steel but semi-hard rubber is now being used in many pilers. The rubber Reinks screens injure the beets less and, because of their flexibility, less mud adheres to them and stones do not break or lock them so frequently. Closely spaced spirally ribbed rolls are sometimes used to further eliminate trash. A wide belt conveyor, mounted under the cleaning equipment, catches the dirt and trash. The driver engages a clutch on this mechanism to deliver the dirt and trash from his load back into his truck. Many pilers use a constantly swinging boom in order to evenly distribute any particularly dirty load of beets over a wide arc rather than deposit them all in one concentrated spot in the pile. The piler is periodically moved back a few feet as the pile is built.

The larger pilers can receive, on the average, a seven-ton truckload of beets each one and one-half minutes.

Several factors are important in determining storage losses. But before considering the over-all storage loss, which takes place between the time the beets are delivered by the grower and the time they are weighed on the beet scales in the factory, a better understanding of what occurs can be gained by considering the normal processes of the beet and the influence of certain environmental factors on these processes.

The harvested sugar beet is the storage part of a very efficient vegetable manufacturing plant. During its first phase of growth it manufactures much more food than necessary for its immediate needs and stores it, very largely in the form of sugar. If allowed to grow for another year, it would normally use this reserve to reproduce itself, raising an abundant crop of seed.

The beet is composed of living tissues. As long as it is kept alive, it has considerable resistance to invading organisms such as fungi and bacteria that would cause it to spoil. All living tissues undergo the normal process of respiration in which oxygen is absorbed, stored food (principally sugar) is used up, and carbon dioxide, water, and energy in the form of heat, is given off. The quantities involved are definite and may be written as follows:

Sugar		Oxygen		Carbon Dioxide		Water		
$C_{12}H_{22}O_{11}$	+	$12\ O_2$	$\longrightarrow$	$12\ CO_2$	+	$11\ H_2O$	+	Energy as heat—enough to heat 62.5 pounds of water from body temperature to boiling
1 lb.		1.12 lb.		1.54 lbs.		0.58 lbs.		

Incidentally, if we reverse the direction of the arrow, we have the general equation for photosynthesis, by which the sugar is synthesized in the leaves of the plant, although other processes use up much more additional energy.

The products of the respiration process (at the right of the arrow) are especially important in modifying the environment of beets in massive piles. Low concentrations of carbon dioxide apparently help to slow down the respiration process slightly and so long as adequate oxygen is present, do not increase spoilage. If the water, given off as vapor, condenses to a liquid on the beets, it creates a very favorable environment for fungi to grow and penetrate into the beet tissues, causing spoilage. The heat given off in the process may keep the beets in the interior of an unprotected pile from freezing, even in very cold weather. This large amount of heat, given off in the respiration process, is probably the greatest source of trouble in the storage problem because it raises the temperature of the beets unless it is dissipated by adequate ventilation. Careful measurements have shown that temperature probably influences the rate of respiration (and heat output) of beets more than any other environmental factor. The normal daily loss of sugar from a ton of beets due to respiration is about 0.11 pounds at 35° F. Each time the temperature is increased 15° the respiration rate, heat output, and sugar loss are approximately doubled. The cause of heavy losses can best be seen by the following values.

Table 19

EFFECT OF TEMPERATURE ON RESPIRATORY LOSS OF SUGAR, HEAT OUTPUT, AND POSSIBLE TEMPERATURE RISE OF BEETS IN STORAGE

Temperature °F.	Amounts per ton of beets per day Sugar loss Lbs.	Heat output B.T.U.	Temperature rise °F.
35	0.11	784	0.46
50	0.22	1,568	0.92
65	0.44	3,136	1.84
80	0.88	6,272	3.68
95	1.76	12,544	7.36
110	3.52	25,088	14.72

These same approximate values may be calculated by the following equation:

Pounds sugar per ton per day $= .11 \ [\ \log_{10} .02007\ (T-35)\ ]$ where T is equal to the temperature in degrees F.

Example: To calculate the sugar loss, heat output, and possible temperature rise of beets stored at 56°F.
56—35=21 .02007×21=.42147 which is the log $_{10}$ of 2.639 (from log tables) 2.639×.11=.29029 lbs. sugar per ton per day.
If we substitute 784 for .11 in the equation we find 2.639×784= 2,068.976 B.T.U. heat output per ton per day.
If we substitute .46 in the equation we find 2.639×.46= 1.21394°F. for the possible temperature rise per day, assuming no heat loss.

Many of the factors that affect the respiration rate of sugar beets also affect the growth of microorganisms that cause spoilage. Higher respiration rates, due to higher temperatures, favor the growth of most fungi and the increased moisture given off also favors their growth and penetration into the beet tissues.

Partial drying before storage increases the respiration and susceptibility to spoilage. Spoilage is first indicated by an increase in the percentage of invert (reducing) sugar.

Wounding of the tissues during harvest operations also increases the respiration rate and susceptibility to spoilage. The dead cells in the wounds have no resistance to invasion and the wound offers a focus of infection to the whole beet.

High topping increases the respiration rate because the crown is composed of more physiologically active tissue, but spoilage is lower in beets that are topped relatively high. Different varieties of beets may vary as much as 40 per cent in respiration rate and individuals within a heterogeneous variety may vary even more. Susceptibility to spoilage varies widely between varieties and also within a given variety. The respiration of large beets is lower than that of the same weight of smaller beets. Clean beets occupy only about 60 per cent of the total volume of a pile. From the above basic data it is evident that storage losses are kept at a minimum when the best varieties of large, freshly harvested, clean beets are stored at the lowest temperature possible without freezing. They should be kept in an environment that produces little drying, no persistent liquid on their surfaces, and they should be ventilated only sufficiently to control temperature.

Length of time in storage is an important factor in determining storage losses. But before considering the over-all storage loss that occurs between the time when beets are delivered by the grower and the time when they are processed, a better understanding of what takes place can be gained by considering the normal experiences of an individual beet at it follows this course.

The bruises and abrasions which the beet receives during mechanical harvesting will vary with the harvester used and the condition of the soil from which it is harvested. However, few machines are built with delicate handling in mind; rather they are built to effectively separate the beet from its top and from adhering soil. The beet may be topped in the ground, passed over a set of Reinks screens, then elevated and dropped into a cart attached to the harvester. Or it may be lifted on a spiked wheel or by its petioles, topped in the machine, and dropped to the ground, truck, or trailer cart. It is then hauled to the nearest receiving station where it is dumped into a hopper from which it is elevated to the cleaning equipment. Here, literally suspended by repeated kicks from the rapidly revolving fingers of the Reinks screens and rolls to remove dirt and trash, it is elevated to the top of the pile. It may come to rest at the top and be repeatedly bruised by other beets from the piler, or it may tumble nearly thirty feet down the face of the pile until it comes to rest at the bottom. Other beets bump over it until it is covered. The weight above it may be more than 850 pounds per square foot, applied to small areas that are in contact with other beets.

The beet has a large wound where the top was cut off; the tip of the root has been broken and there is probably not a square inch of surface that has not been subjected to bumps or abrasions, yet it stores remarkably well if it is subjected to no further mistreatment. If it is harvested by hand it experiences much the same bumping and abrasions but, more important, there is the possibility that it may be left in the windrow for some time before it is loaded and taken to the receiving station. If left in the windrow for very long the beet may be warmed and dried out by the sun and wind or it may be slightly frosted during cold weather. The mechanically harvested beet usually reaches the pile in a cooler and fresher condition, although it may be accompanied by more dirt and trash.

If the beet has been harvested early in the season it has been stored during warm weather and may have a relatively high temperature and respiration rate. The beet harvested later has the advantage of storage with lower initial temperature. Beet-breeding programs are being modified to evaluate varieties for lower respiration rate and greater resistance to spoilage, and studies to further improve the better existing varieties are in progress.

With this picture of the individual beet as a background we can consider the large storage pile. In current practice the belt conveyor delivers the beets first into a conical pile at the beginning. The beets fall some distance and are usually somewhat broken. These fragments are serious sources of decomposition. They not only respire and spoil more rapidly but they also fill up the spaces between beets and effectively stifle the normal circulation of air. As the pile builds up to full height the larger and cleaner beets roll to the outside and to the foot of the pile. Dirt, trash, and small beets drop vertically and tend to accumulate in a core directly under the end of the conveyor. After the initial cone reaches full height the rest of the beets are added in such a manner that they roll down the slope with decreased violence and less breakage.

Present-day pilers build a pile 22 feet high, 140 feet wide at the base, and 110 feet in width at the top. These types of pilers build in a series of crescents representing each new location of the piler as the boom swings from one center position after another, or in a series of parallel layers, extending the length of the pile, for other types of pilers which move along the edge of the pile. In either case we have a concentration of small beets, trash, and dirt directly under the point of discharge and large, relatively clean beets at some distance from this point. The edges or shoulders of the pile contain a greater concentration of dirt and trash because more beets are delivered here to form the outside slope of the pile.

Soil or dirt, as distinguished from trash, does not always promote decay. Beet breeders have found that mother beets may be stored over winter with little loss if they are first dipped in a thin batter of mud that completely coats them. The coating of mud prevents excessive drying. Trash is always a hazard since it contains moisture and is in itself a focus of decomposition.

The length of the pile will be determined by the volume of beets to be stored or by the limitations of the piling ground. When it is completed the pile will contain a wide range of internal and external conditions. In addition to those previously discussed there will exist the differences due to sunshine, prevailing winds, and external temperatures.

Forced ventilation of piled beets has proven effective in reducing storage loss. In some areas, especially where normal storage losses are high, nearly all storage piles are force-ventilated. In other areas where normal storage conditions are usually good, the practice has not been so generally adopted because of the cost of equipment and the inconvenience of piling and recovering the beets. Lower temperatures can be maintained in piles that are force-ventilated, without excessively drying the beets, by blowing air into the pile when the temperature and humidity of the air is most effective for cooling. Such a practice has the additional advantage of effective insurance against spiraling temperature increases that are not controlled by normal ventilation and threaten very heavy or complete loss of the beets unless they can be processed before such loss occurs. Fortunately, a whole pile of beets does not start to spoil uniformly, but develops so-called "hot spots." These hot spots usually develop first in the end where the pile was started and along the top edges or shoulders where dirt, trash, and broken beets do not allow adequate natural ventilation.

Forced ventilation of piled beets is usually accomplished by placing ducts at intervals of about twenty feet across the base of the pile and reaching inward to a point below the opposite shoulder. The ducts usually consist of oil drums which have had the tops and bottoms removed and short pieces of strap iron welded to one end to keep them in alignment. The drums are spaced 1½ to 2 inches apart to allow for air distribution to the pile.

Existing underground flumes, built to convey the beets in water to the factory, are sometimes used as air ducts, but the flumes usually run lengthwise of the pile and do not allow for flexibility in air distribution. The heavy equipment used to pile and recover the beets increases the probable construction cost of an underground duct system, but greater flexibility of air distribution and longer life would seem to favor such a system. A pile of beets 140 feet wide at the base, 110 feet wide on top, and 22 feet high will contain about fifty tons of beets per linear foot. Blower capacity of about ten to twenty cubic feet of air per minute per ton of beets is usually considered advisable, although very effective results have been reported with considerably less air, especially if the distribution system is flexible and air temperatures are favorable after piling.

Controlled experiments have shown that the air reaches 90 to 100 per cent relative humidity after passing through an eight-foot layer of beets and that the difference in temperature between the air and beets on the top of a twenty-four-foot column of beets is about one third that of the top and bottom beets. Heat and moisture transfer to the ambient air is relatively rapid. The probable average rate of cooling can be calculated for any given conditions. Because of the fact that the air is nearly saturated with water vapor after traveling only a few feet, evaporative cooling frequently exceeds that of the sensible heat transfer to the ambient air.

The static pressure at the base of an experimental column 3 feet in diameter and 24 feet high, and ventilated at the rate of 150 cubic feet per minute, was increased only 0.1-inch (water pressure) when the column was filled with three tons of beets and ventilated at the same rate. This corresponds to a ventilation rate of 50 c.f.m. per ton of beets. The design of the distribution system or heavy concentration of dirt or trash is evidently responsible for practically all of the resistance to the flow of air in a force-ventilated pile of beets.

When complex factors of the environment of stored beets are considered, it would seem almost futile to attempt to establish any formulas for storage losses. Some information on storage losses in commercial piles that were force-ventilated and where spoilage was practically absent, have shown a close agreement with normal respiration losses at the same temperature. Under average conditions in the intermountain states, where forced ventilation is not used, we can anticipate with some degree of accuracy the probable storage losses. In general, the following rules may be used as a guide:

1. After an initial higher rate of loss during the first few days following harvest, total storage loss is usually proportional to time of storage until actual decomposition begins.

2. Beets, while in transit in railroad cars, suffer an accelerated rate of loss. This loss may amount to 2.5 pounds of sugar per ton of beets per day.

refined sugar values move up accordingly), he purchases his actual sugars, and he simultaneously sells the futures contracts which he had originally bought. In effect, then, he obtains his refined sugar more cheaply than he would have, had he simply waited and purchased refined sugars with no futures commitments. This type of hedge is known as a "buying hedge."

From the foregoing it can easily be seen that there is no need for anyone who does not wish to take a market risk in the production, processing, or distribution of sugar to do so. Either some one else who has an opposite need takes the hedge or the speculator is at all times available to remove this burden from the shoulders of the person in the trade.

The Exchange as a Medium for Pricing Raw Sugar Contracts: In the previous section on raw sugar we discussed briefly the exchange as a method of pricing raw-sugar contracts between buyer and seller.

Constant Familiarity with the Futures Market Vital: The question may here arise, "Why it is important for anyone, not directly interested in the sugar-futures market, to remain in active touch with futures?" First of all, we have already covered the reasons behind the necessity for an active contact in the actual raw market. In view of the fact that the futures market presents the most accurate indicator possible of the future value of raw sugar, the two markets—raw sugar and futures—are actually inseparable. A person cannot be well versed in the raw-sugar market unless he is conversant with futures. This is particularly true in the light of the various pricing arrangements which take place on the futures exchange but which, as has been pointed out above, also establish the price at which actual raw sugars change hands. To know the actual raw market and yet be ignorant of developments in the futures market is like carefully studying the *Encyclopaedia Britannica* from A to K but completely ignoring the section from L to Z.

And, of course, the fact is that the price of refined sugar in the United States, whether it be beet or cane sugar, is dependent to an important degree upon the price of raw cane sugar.

The Selling, Merchandising, and Distribution of Refined Sugar

United States Cane-Sugar Refineries: It has been previously pointed out that the greatest proportion of refined cane sugar distributed in the United States is produced in Boston, New York, Philadelphia, Baltimore, Savannah, New Orleans (and vicinity), and in Sugar Land, Texas, and Crockett, California. Let us now examine the picture by individual refiners and see where each maintains its refinery or refineries.

The American Sugar Refining Company owns five refineries, situated in Boston, New York (Brooklyn), Philadelphia, Baltimore, and New Orleans (Chalmette).

The National Sugar Refining Company produces refined sugar at its two plants—one in New York (Long Island City) and one in Philadelphia.

The Revere Refinery, owned by the United Fruit Company, is located in Boston (Charlestown).

The Savannah Sugar Refining Corporation has one refinery—located at Savannah (Port Wentworth), Georgia.

The California and Hawaiian Sugar Refining Corporation, Ltd., produces refined sugar at Crockett, California, which is near San Francisco.

The refinery of the Colonial Sugars Company is situated at Gramercy, Louisiana. Godchaux Sugars, Inc., refine sugar at Reserve, Louisiana. The Henderson Sugar Refinery is located within the city limits of New Orleans. However, a new refinery is planned at Mobile, Alabama, which will replace the present New Orleans plant.

The Imperial Sugar Company refines cane sugars at Sugar Land, Texas.

The foregoing refiners use the "bone-char" process and are producers of "full assortments" of refined sugar. In other words they produce wide assortments of various grades and grain sizes of sugar (including soft or brown sugars), packed in packages ranging from one-hundred-pound bulk bags down to one-pound cartons.

In addition to those listed above, there are refiners, using other processes, who produce limited assortments. Their names, and the location of their refineries, are listed below:

Refined Syrups and Sugars, Inc.	Yonkers, N.Y.
Sucrest Division of the American Molasses Co.	Brooklyn, N.Y.
Fellsmere Sugar Producers Assn.	Fellsmere, Fla.
Okeelanta Sugar Cooperative	Okeelanta, Fla.
J. Aron Co., Inc.	Tallieu, La.
The South Coast Corporation	Matthews, La.
Sterling Sugars, Inc.	Franklin, La.
Southdown Sugars, Inc.	Houma, La.

In addition there are several small plants situated at interior points, such as Milwaukee, Chicago, and St. Louis, and at New

Orleans, where raw sugar is treated and liquid sugar is produced.

United States Beet-Sugar Processors: Following is an alphabetical list of United States beet-sugar processors and the location of the plants of each:

Amalgamated Sugar Company	Lewiston, Utah Burley, Idaho Rupert, Idaho Twin Falls, Idaho Nyssa, Ore. Nampa, Idaho
American Crystal Sugar Co.	Oxnard, Calif. Clarksburg, Calif. Missoula, Mont. Rocky Ford, Colo. Grand Island, Neb. Mason City, Iowa Chaska, Minn. East Grand Forks, Minn. Moorhead, Minn.
The Buckeye Sugar Company	Ottawa, Ohio
Franklin County Sugar Co.	Preston, Idaho Mount Clemens, Mich.
The Garden City Company	Garden City, Kan.
Great Lakes Sugar Company	Blissfield, Mich. Fremont, Ohio Paulding, Ohio Findlay, Ohio
Gunnison Sugar Company, Inc.	Centerfield, Utah
Lake Shore Sugar Company	Holland, Mich. St. Louis, Mich.
Layton Sugar Company	Layton, Utah
Great Western Sugar Co.	Loveland, Colo. Greeley, Colo. Eaton, Colo. Fort Collins, Colo. Windsor, Colo. Longmont, Colo. Sterling, Colo. Brush, Colo. Fort Morgan, Colo. Billings, Mont. Scottsbluff, Neb. Lovell, Wyo. Gering, Neb. Bayard, Neb.

	Brighton, Colo. Mitchell, Neb. Fort Lupton, Colo. Ovid, Colo. Lyman, Neb. Wheatland, Wyo.
Holly Sugar Corporation	Alvarado, Calif. Swink, Colo. Hamilton City, Calif. Dyer, Calif. Sheridan, Wyo. Worland, Wyo. Tracy, Calif. Delta, Colo. Sidney, Mont. Torrington, Wyo. Hardin, Mont. Carlton, Calif.
Menominee Sugar Company	Green Bay, Wis.
Michigan Sugar Company	Alma, Mich. Caro, Mich. Croswell, Mich. Carrollton, Mich. Sebewaing, Mich. Lansing, Mich. Mount Pleasant, Mich.
Monitor Sugar Division of Robert Gage Coal Company	Bay City, Mich.
National Sugar Manufacturing Co.	Sugar City, Colo.
Superior Sugar Refining Co.	Menominee, Mich.
Union Sugar Company	Betteravia, Calif.
Spreckels Sugar Company	Spreckels, Calif. Manteca, Calif. Woodland, Calif.
Utah-Idaho Sugar Company	Garland, Utah Idaho Falls, Idaho Blackfoot, Idaho Spanish Fork, Utah West Jordan, Utah Shelley, Idaho Toppenish, Wash. Chinook, Mont. Belle Fourche, S.D.

Offshore Refined: In addition to the refined sugar produced by the domestic cane refiners and beet-sugar producers, refined sugar is also produced in offshore areas. In Cuba, there are sixteen brands of refined cane sugar produced and sold to buyers in the United States. Puerto Rico currently ships four brands of refined sugar into United States markets; the Philippine Islands supply us with three brands of refined sugar, and one brand is produced in Hawaii.

Cuban and Puerto Rican refined sugars substantially enter the ports of Boston, New York, Philadelphia, Baltimore, Wilmington (North Carolina), Charleston (South Carolina), Savannah, Jacksonville, Miami, and Tampa. Philippine and Hawaiian refined sugars enter through West Coast ports.

Partially Refined Sugars: Whereas the above refiners and beet processors supply by far the greatest proportion of the direct-consumption sugar distributed in the United States, there are, in addition, other sugars—turbinados and various grades of plantation granulated sugar—produced by both domestic and offshore producers, which are also sold here. In general, these sugars are highly washed raw sugars, dried by steam and whitened by a process of sulfitation. They are, however, marketed here in relatively small quantities. Then, too, there is some relatively small trade in raw sugar for direct consumption, principally by tobacco companies.

Refined Sugar Available in Many Types and Packages

When one reviews the development of the art of sugar manufacture, it is fascinating to realize that, steadily, over the centuries, not only has greater and greater extraction of sugar been obtained from the sugar-bearing plants—sugar cane and sugar beets—but also there has been tremendous development in the production of a wide variety of grades of refined sugar. Now, sugar is supplied in many types and sizes of packages. Dry refined sugar is available today in grades and packaging as follows:

Grade	Style of Packing In Containers, each containing:	
Granulated	48	1-lb. cartons
	24	2-lb. cartons
	12	5-lb. cartons
Confectioners XXXX	24	1-lb. cartons
Fruit Granulated	24	1-lb. cartons
Powdered	24	1-lb. cartons
Dark Brown	24	1-lb. cartons
Light Brown	24	1-lb. cartons
Crystal Tablets	30	2-lb. cartons
Crystal Squares	24	1-lb. cartons

Pressed Tablets	30 2-lb. cartons
	12 2-lb. cartons
	25 lbs. in bulk
Dainty Lumps	24 2-lb. cartons
Dots	24 1-lb. cartons
Small Cubes	25 lbs. in bulk
Cafe Cubes	25 lbs. in bulk
Cut Loaf	25 lbs. in bulk
	In paper bags, each containing:
Granulated	30 2-lb. bags
	12 5-lb. bags
	6 10-lb. bags
	25 lbs. in bulk
Confectioners XXXX	25 lbs. in bulk
Confectioners XXXXXX	25 lbs. in bulk
Extra Fine	25 lbs. in bulk
No. 6 Soft-Light Yellow	25 lbs. in bulk
No. 8 Soft-Medium Yellow	25 lbs. in bulk
No. 10 Soft-Golden Brown	25 lbs. in bulk
No. 13 Soft-Dark Brown	25 lbs. in bulk
	In cotton pockets, each containing:
Granulated	4 25-lb. bags
	10 10-lb. bags
	20 5-lb. bags
	In 100-lb. paper bags
Fine Granulated*	" " " "
Extra Fine Granulated*	" " " "
Bottlers Granulated*	" " " "
Canners Fine Granulated	" " " "
Sanding*	" " " "
Medium Fine Granulated*	" " " "
Medium Granulated*	" " " "
Standard Granulated*	" " " "
Coarse Granulated	" " " "
Microfine	" " " "
Confectioners XXXXXX	" " " "
Confectioners XXXX	" " " "
Standard Powdered	" " " "
Coarse Powdered	" " " "
Coating	" " " "
Bakers Special*	" " " "
Fruit Granulated*	" " " "
No. 6 Soft-Light Yellow	" " " "
No. 8 Soft-Medium Yellow	" " " "
No. 10 Soft-Golden Brown	" " " "
No. 13 Soft-Dark Brown	" " " "

Specialty grades	Style of packing
Tablets	Individually Wrapped in containers; 10 cartons of 500 tablets each (total 5,000 tablets)

* These grades available also in one-hundred-pound single cotton bags.