UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
FRUIT AND VEGETABLE DIVISION
PROCESSED PRODUCTS STANDARDIZATION AND INSPECTION BRANCH
WASHINGTON, D. C.

INSTRUCTIONS FOR INSPECTION

of

SUGARCANE SIRUP

FOR USE OF USDA PROCESSED FOODS INSPECTORS

AUGUST 1957

INSPECTORS' INSTRUCTIONS
FOR
SUGARCANE SIRUP

August - 1957

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INSPECTORS' INSTRUCTIONS
FOR
SUGARCANE SIRUP

August - 1957

I GENERAL

A Purpose and Scope.

The instructions contained herein explain and furnish technical information which will serve as a guide in the inspection of sugarcane sirup and will aid inspectors in attaining uniformity in applying the United States Standards for grades of this product and in the proper certification of the product. These instructions will also serve to familiarize the inspectors with the commercial product and the general packing procedure used by industry.

B Caution.

Inspectors are reminded that these are administrative instructions for their use only and are not for public distribution.

C Keep Instructions Current.

These instructions may be revised, in whole or in part, whenever the need for such revision is indicated. Therefore, any comments or suggestions such as detection of errors or the development of new and better inspection techniques should be forwarded in detail to the Washington office.

II PRODUCTION

The States in which sugarcane sirup is produced are Louisiana, Mississippi, Georgia, Alabama, Florida, Texas, South Carolina, and Arkansas. Sugarcane sirup is produced principally in Louisiana and the Southeastern States. The mills in Louisiana generally are larger than those in the Southeastern States and much of the sirup is "sulfured sirup" which is made by the sulfitation process. The sirup produced in the Southeastern States is processed on small farm mills where the sulfitation process is not used. A considerable quantity of it is canned at the mill for sale to wholesalers or retailers; the remainder is barreled and sold to blendors or to accumulators for resale or blending.

II PRODUCTION (Continued)

A Annual Production.

The annual production of sugarcane sirup increased during the period of World War II, during which time sugar was rationed. Production declined sharply following this period due, in part, to the competition of other sweeteners, unfavorable crop conditions, and also to the unsatisfactory quality of the sirup offered. The following table gives the annual production for the years indicated in the principal producing areas:

II PRODUCTION (Continued)

A Annual Production. (Continued)

PRODUCTION OF SUGARCANE SIRUP, BY STATES, 1940-54
(Thousand Gallons)

Year	La.	Ga.	Miss.	Ala.	Fla.	Texas	S. C.	Ark.	Total U. S.
1940	5,720	2,530	1,350	1,500	1,120	750	320	125	13,415
1941	6,240	3,564	3,135	2,760	1,600	840	500	125	18,764
1942	5,760	3,900	3,300	2,645	1,760	665	485	95	18,610
1943	7,975	4,250	2,992	2,875	2,040	700	648	95	21,575
1944	6,670	4,356	3,630	2,760	2,240	750	570	95	21,071
1945	15,075	4,564	3,520	2,860	2,090	260	342	--	28,711
1946	11,825	4,025	3,500	2,430	1,980	270	420	--	24,450
1947	8,460	4,070	2,600	2,160	2,400	280	300	--	20,270
1948	2,200	3,600	2,890	2,240	1,980	230	350	--	13,390
1949	2,600	3,150	2,030	1,820	1,620	320	230	--	11,770
1950	3,960	2,100	1,040	1,150	980	--	--	--	9,230
1951	2,880	1,360	360	480	960	--	--	--	6,040
1952	3,280	1,190	360	450	725	--	--	--	6,005
1953	2,225	1,260	560	450	1,080	--	--	--	5,575
1954*	2,590	720	270	375	840	--	--	--	4,795

*Preliminary.

Source: Agricultural Statistics.

II PRODUCTION (Continued)

B Varieties of Sugarcane.

Sugarcane is a large grass belonging to the so-called noble cane group which comprises all of the cultivated varieties of the world. The development of varieties giving higher yields of sugar has resulted in gradual replacement of the old with the new varieties. The so-called native canes which have been cultivated in a given location for many years are principally used in the production of sugarcane sirup. Some of the named varieties are Canal Point and Coimbatore. These are varieties which are also used for the commercial production of sugar (sucrose) and should not be confused with the sorghum canes which are used for making sorghum sirup.

Sugarcane is grown from cuttings of the cane which are planted end to end in a row, with a very shallow covering of soil. The buds located at the nodes or joints produce a plant which sends out several shoots or suckers. The suckers form a group or clump of canes. Cuttings are usually planted but once in several years under suitable climatic conditions. After harvesting, new plants spring up from the stubble. These are called ratoons, which produce the second and later crops, being limited in number by soil or climatic conditions. Frequently, this is limited to one planting crop followed by two ratoon crops.

Sugarcane is harvested in the last quarter of the year, usually as late as possible prior to freezing weather, to permit the sugar content of the cane to approach its maximum. Production usually begins in October and may continue through January. November is the month of heaviest production. The type of soil in which the cane is grown, the variety of cane grown, milling equipment, and boiling house equipment, all have an effect on the quality of the sirup.

1 Harvesting.

In harvesting sugarcane for sirup, the stalks may be cut off close to the ground and should be topped just above the highest colored joint. This may vary in different localities, and in some instances the top joints, although having a lower sucrose content, are not removed. The leaves are removed at the same time the stalks are cut and topped. Hand cutting is generally practiced but machine harvesting has been used to some extent recently with the invention of two machines

II PRODUCTION (Continued)

B Varieties of Sugarcane. (Continued)

1 Harvesting. (Continued)

for this purpose. These are the Munson-Thompson and the Wurtele cane harvesters. As sugarcane deteriorates rapidly, it should be conveyed to the mill as soon as possible and ground immediately. When freezes occur, the cane must all be cut immediately to prevent fermentation and excessive deterioration which reduce yields and lower the quality of the sirup. In some regions, it is customary to cut, top, and strip cane in advance of freezing weather. Such cane is piled and covered with leaves and tops to protect it and keep it from freezing. If properly handled and if weather is not too severe, this cane will keep satisfactorily for a month or more.

C Types of Sugarcane Sirup.

Sugarcane sirup is of two types:

1 Unsulfured sugarcane sirup.

2 Sulfured sugarcane sirup.

D Manufacture of Sugarcane Sirup.

Sugarcane sirup is made directly from the juice of the cane by concentrating to the required Brix degree without removing any sugar. Essentially, the processing of sugarcane sirup is similar in all mills with the exception of a single process, sulfitation, which may or may not be used. Sugarcane is brought from the fields after cutting, either directly to the mills by tractor and cart, or first to a field derrick where the cane is loaded from the carts to trucks or railroad cars for delivery to the mill. The sugarcane, when unloaded, may go directly to the mill carrier or may be stored for a short period of time before entering the milling process. It is a perishable product and may deteriorate during the time that elapses between cutting and milling. The cane passes through a battery of mills, the number and applied pressure of which vary considerably as between the small farm type establishments and the large commercial mills. Generally, the greater the number of mills and the higher the pressure applied, the greater will be the proportion of the juice in the cane which is actually extracted. However, the larger mills may also result in a higher proportion of impurities

II PRODUCTION (Continued)

D Manufacture of Sugarcane Sirup. (Continued)

in the juices because of the heavy pressures applied, and it is generally conceded that the best sugarcane sirup is produced when extreme milling pressures are not in use.

1 Unsulfured sugarcane sirup.

Unsulfured sugarcane sirup is made by concentrating the juice by boiling without any chemical treatment. This is the type of sirup produced in plants of small capacity. The cane is usually crushed in a single mill equipped with three rollers. The juice is strained and run into clarifyers to remove suspended material, and then to the evaporator. The evaporators in the smaller plants are usually direct fired. The application of heat clarifies the juice, the albuminoids are coagulated and rise to the surface, entrapping small particles of extraneous material from cane and forming a scum which is removed by skimming or brushing. The skimming or brushing continues during evaporation until the desired concentration is reached. Sirup produced by this simple method will generally have an excellent flavor.

2 Sulfured sugarcane sirup.

In the sulfitation process, the juice is treated with sulfur dioxide and then with hydrated lime. The sulfured type of sirup is generally produced by the larger processors. The plant usually consists of a crusher with six or more rollers, having a daily capacity of 200 tons of cane or more, depending upon other plant facilities. The juice is strained and saturated with sulfur dioxide. The juice should absorb sufficient sulfur dioxide to give an acidity equivalent to 3.0 to 4.0 ml of 0.1N alkali per 10 ml of juice. This sulfitation is followed by liming. The lime used is powdered hydrated lime ($Ca(OH)_2$) or very finely pulverized quicklime. The acidity is reduced by liming to 0.8 to 1.5 ml of 0.1N alkali per 10 ml of juice. The juice is then boiled and allowed to settle. The clear juice is then decanted or filtered. The clear juice may then be partially evaporated and again allowed to settle, after which the clear sirup is further evaporated in open evaporators to the required Brix. The sirup is usually held for several weeks in large tanks before canning. A large part of sulfured sirup is sold in bulk for blending with molasses or glucose for table use and for cooking.

III DEFINITION

A Definitions.

1 "Sugarcane sirup" means the liquid product obtained by evaporating the juice of sugarcane or by dissolving sugarcane concrete in water without removing any of the sugar therefrom.

2 "Unsulfured sugarcane sirup" is sugarcane sirup made without the use of the sulfitation process.

3 "Sulfured sugarcane sirup" is sugarcane sirup made by the sulfitation process.

IV CANNING PROCEDURES

A Preparation for Canning.

1 Blending.

In the preparation of blends of sirup for canning, considerable skill is required to maintain uniform color and flavor in the finished canned product. Sirup from different sources or different batches by the same producer may vary considerably due to the method of manufacture, condition and variety of the cane, or skill in handling plant operations. Careful blending is necessary to maintain uniform quality in the canned product.

2 Filling.

After blending, the sirup is heated to a filling temperature of 180° to 185° F. In larger plants the sirup is heated in copper or stainless steel processing pans equipped with steam coils. These pans have a capacity of six to eight barrels (300 to 400 gallons). In smaller plants the cans may be filled direct from the evaporator or from holding tanks which are supplied direct from the evaporator. When filling direct from the evaporator, provisions should be made for cooling the sirup to prevent overheating and caramelization in the can.

IV CANNING PROCEDURES (Continued)

A Preparation for Canning. (Continued)

3 Cooling.

After filling, the cans should pass through a spray of water to wash off any adhering sirup. The cans may then be air-cooled before labeling and casing. If the cans are cased and sealed before cooling, considerable caramelization is likely to occur which will adversely affect the color and flavor of the sirup.

4 Containers.

Plain cans or glass containers are ordinarily used for sugarcane sirup. These should be types of containers which can be hermetically sealed, such as the double-seamed metal containers and glass containers provided with a suitable metal closure. The use of friction top metal containers is not recommended for sugarcane sirup due to the increased hazard of spoilage. However, this type of container is frequently used, particularly by producers with small production capacity.

V FOOD AND DRUG REQUIREMENTS

A General Requirements.

The overall provisions of the Food, Drug, and Cosmetic Act apply in general to canned sugarcane sirup. The product must be packed under sanitary conditions, must not be adulterated or contimated with decay, insects, or filth, and must be truthfully labeled.

B Standard of Identity.

No standard of identity or quality has been issued by the Food and Drug Administration for sugarcane sirup. However, under an advisory standard adopted as a guide for enforcement officials the product was defined as follows: "Cane sirup. Sirup made by the evaporation of the juice of the sugarcane or by the solution of sugarcane concrete. It contains not more than 30 percent of water and not more than 2.5 percent of ash."

V FOOD AND DRUG REQUIREMENTS (Continued)

B Standard of Identity. (Continued)

The recommended maximum ash content for the different types of sugarcane sirup are in substantial agreement with the Food and Drug advisory standard, the apparent difference being due, in part, to different methods of analyses which may be employed. The methods of analyses provided in the revised grade standards are in general use in the industry, and data indicate that the recommended maximum ash content reflects current production practices.

C Required Label Statements.

In addition to the name of the product, "sugarcane sirup," the net contents and the name and address of the packer or distributor must be shown on the label. The brand name, vignette, and other material such as recipes and descriptive material are optional with the packer or distributor. However, the labeling should not be false or misleading in any way.

VI INSPECTION OF THE PRODUCT

A Sampling.

The sampling rates prescribed in the Rules and Regulations and applicable Inspectors' Instructions should be followed. The condition of the containers in the lot, such as freedom from swells, springers, leakers, and rusty containers should be ascertained at time of sampling in accordance with applicable instructions. The number of cases in the lot and warehouse location should be recorded as a means of identification in the event that supervision of loading is requested. Whenever it appears that there may be some question as to the grade of the lot or the quality is likely to be irregular, or a wide variation in Brix solids or some other deviation is anticipated, the appropriate sampling plan should be selected in accordance with the plans provided in the regulations.

VI INSPECTION OF THE PRODUCT (Continued)

B Inspection Equipment and Material.

The following lists comprise the minimum equipment and supplies needed by the inspector on a field trip. These items of equipment would be needed when laboratory facilities are not available at the plant or warehouse where the inspection is to be made. A telephone call to the applicant or processor before proceeding on a field trip is often desirable to obtain information which will facilitate the handling of the inspection.

1 Equipment for inspection.

a Grading scales.

b Vacuum gauge.

c Can opener.

d Trays, white enamel, shallow, about 10" x 14".

e Depth gauge.

f Ruler.

g U.S.D.A. permanent glass color standards for sugarcane sirup.

h Two U.S.D.A. cane sirup sample containers.

i 200 ml beakers.

j Refractometer.

k Cylinders.

l Brix hydrometers.

2 Materials and supplies or information needed.

a U. S. Standards for Grades of Sugarcane Sirup.

b Federal Specifications.

c Inspectors' Instructions for sugarcane sirup and any supplemental instructions.

VI INSPECTION OF THE PRODUCT (Continued)

B Inspection Equipment and Material. (Continued)

2 Materials and supplies or information needed. (Continued)

d Sampling sheets.

e Score sheets.

f Contract instructions and specifications, location and size of lot, name of applicant or contractor, and similar applicable data.

g Towels.

h Marking crayons.

i Sampling stamp.

j Application for inspection.

k Regulations governing inspection and certification of processed fruits and vegetables and related products, July 1, 1957.

C General Inspection Procedure.

The United States Standards for Grades of Sugarcane Sirup define and describe the requirements for the different grades and outline the procedure for inspecting the product. Certain of these requirements are contained in the product description. These include provision for the preparation of a clean, sound, liquid sugarcane product. It is the policy of the Branch, in so far as possible, to ascertain that the product complies with the basic Food and Drug requirements in accordance with methods, procedures, and administrative guides provided for the use of inspectors and supervisors. Provision for the application of methods and procedures and administrative guides not specifically outlined in the standards is contained in Section 52.3105 of the grade standards which states in part, "In addition to considering other requirements outlined in the standards . . . ."

VI INSPECTION OF THE PRODUCT (Continued)

D Recording Inspection Data on Score Sheet.

The information required for recording in the score sheet includes size and kind of container, when packed in consumer size containers, brand name, statement of net contents, name and address of packer or distributor, code marks or other identification, fill of container, and any other information which may be essential in the evaluation of the quality and condition of the product.

E Fill of Container.

1 Net contents.

The net contents of the container when packed in consumer size cans may be expressed in terms of weight or measure, as sugarcane sirup falls into the category as a thick and viscous fluid. Containers should be filled as full as practicable. The sirup should occupy not less than 93 percent of the total capacity of the container in containers of gallon capacity and less. When inspecting bulk lots the quantity declared by the packer should be recorded. If any question should arise as to the quantity in bulk containers, the processor may be requested to verify the amount by any suitable method such as weighing or measuring that is satisfactory to the applicant or inspector. The equivalent fill of container in terms of U. S. gallon and net weight is given in Table No. 7 hereof.

The net contents of the container may be determined by weight which can then be converted to liquid measure. The usual procedure in making net weight determinations is to place a complete clean, dry, empty container on the weight plate of the scales or set the counterpoise on the tare beam to offset the weight of the container. The weight can then be recorded directly as the net weight of the product in the container. The average net weight of all the containers in the sample should be equal to or greater than the label statement of the net contents of the container. The net weight of any container which falls below the indicated label weight should be within the range of variability of good commercial practice.

VI INSPECTION OF THE PRODUCT (Continued)

E Fill of Container. (Continued)

2 Headspace.

When the headspace appears to be excessive, careful measurement of the headspace should be made with a depth gauge. If the headspace is in excess of 7 percent of the total capacity of the container, it should be classified as slack filled.

F Grade Factors Rated by Score Points.

1 Color.

The color of sugarcane sirup varies considerably with the method used in production, the condition of the cane, and the canning procedure employed by the packer. Partially crystallized sirup is liquefied by heating to approximately 54.4° C. (130° F.) and cooled to approximately 20° C. (60° F.) before classifying the color of the product.

The sample is placed in a sample container which should be clean and dry. Follow the procedure outlined in the standards. Compare the color of the sample with the U.S.D.A. permanent glass color standards. Place the sample container successively in compartments 2 and 4 of the comparator and make the comparison visually by looking through the sample and the color standard toward a diffuse source of natural or artificial light.

To score in the Grade A classification - 27 to 30 points - the color must be equal to or lighter in color than U.S.D.A. permanent glass color standard No. 1 for sugarcane sirup.

When the color is equal to or better than U.S.D.A. color standard No. 2 a score in the Grade B classification - 24 to 26 points - may be given. As there is no limiting rule in the Grade B color classification, the product may be graded U. S. Grade A when the color falls into this classification, provided that the total score for all factors is 90 points or over.

If the color is equal to or lighter than U.S.D.A. color standard No. 3 it falls in the Grade C classification and may be scored 21 to 23 points. When scored in this classification the product cannot be graded above U. S. Grade C regardless of the total score as this is a limiting rule.

VI INSPECTION OF THE PRODUCT (Continued)

F Grade Factors Rated by Score Points. (Continued)

2 Flavor.

Both the flavor and odor of the sirup should be considered in evaluating the factor of flavor. The method of manufacture or type of sugarcane sirup is taken into consideration in scoring this factor. The open pan sirup will be noticeably different in flavor from sulfured sirup. However, each type should be evaluated on its own merits regardless of individual preference. The sirup should be free from fermented or off flavors of any kind.

To receive a score of 27 to 30 points in the Grade A classification, the product should have a good characteristic flavor for the type, free from objectionable flavors caused by scorching, fermentation, or any foreign or disagreeable flavor regardless of origin.

A score of 24 to 26 points may be given to the product having a reasonably good flavor. A limiting rule in this classification prevents sugarcane that is scored in this classification from grading above U. S. Grade B regardless of the total score. As previously indicated, the product should be free from objectionable or off flavors of any kind. When the product received a score of 21 to 23 points for flavor, a limiting rule applies and the sirup cannot be graded above U. S. Grade C. Sugarcane sirup having a fermented or scorched flavor or any off flavor, regardless of the cause, should be scored in the Substandard classification and cannot be graded above Substandard due to the application of a limiting rule.

3 Defects.

This factor refers to the degree of cleanliness of the product and to the degree of freedom from harmless extraneous material such as particles of sugarcane fiber or any particle of earthy material or other defects which may be in suspension or deposited as sediment in the container.

VI INSPECTION OF THE PRODUCT (Continued)

F Grade Factors Rated by Score Points. (Continued)

3 Defects. (Continued)

In determining sediment the contents of the container should stand undisturbed for at least two hours at room temperature. When time permits the sample should stand overnight for the determination of defects in the product. The amount of the defects deposited on sides and bottom of the container can be observed and scored.

When the product is practically free from defects, a score in the Grade A classification - 18 to 20 points - may be given. To be practically free from defects the appearance and eating quality of the sugarcane sirup are not affected by the presence of harmless extraneous matter or other material which may be in suspension or deposited as sediment in the container.

When reasonably free from defects, the sirup may be given a score of 16 or 17 points. Sugarcane sirup is considered to be reasonably free from defects when the presence of harmless extraneous matter or other material does not materially affect the appearance or edibility of the product. When scored in the Grade B classification for flavor the product cannot be graded above U. S. Grade B due to the application of a limiting rule.

A score of 14 or 15 points is given when the presence of defects does not seriously affect the appearance and edibility of the product. A limiting rule is applicable in this classification.

When the product falls into the Substandard classification for defects it cannot be graded above Substandard due to the application of a limiting rule.

4 Clarity.

This factor has reference to the presence of fine particles of mineral, colloidal, or amorphous material which is in suspension or is dispersed throughout the sirup and its effect on the clarity, appearance, or edibility of the product.

VI INSPECTION OF THE PRODUCT (Continued)

F Grade Factors Rated by Score Points. (Continued)

4 Clarity. (Continued)

When the sirup is practically clear it may contain not more than a trace of finely divided particles which do not affect the appearance or edibility of the product. A score in the Grade A classification - 18 to 20 points - may be given.

When the sirup is reasonably clear the presence of finely divided particles does not materially affect the appearance or edibility of the product and a score of 16 or 17 points may be given.

When fairly clear a score in the Grade C classification is given and the product cannot be graded above Grade C due to the application of a limiting rule. To score in this classification the appearance or edibility of the sirup may be materially but not seriously affected by the presence of defects.

VII CERTIFICATION

A General.

The certification of sugarcane sirup and preparation of inspection reports shall be in accordance with applicable general instructions as contained in Chapter IV of Instructions for Certification of Processed Products. The instructions in this section relating to certification are those which may differ or supplement such instructions as they apply to sugarcane sirup.

B Product Inspected.

The name of the product as indicated by the grade standards is "Sugarcane sirup." This name should be shown in the space for indicating the product inspected. The type of sugarcane sirup, whether "sulfured" or "unsulfured," should be shown in the body of the certificate. Inspectors may not always be able to determine whether the product is a "sulfured" or "unsulfured" sirup. This is particularly true when the product is a blend of sirups. When the processor or buyer desires to have the type of sirup shown in the certificate and the inspector is unable to definitely identify the type, a statement similar to the following may be used:

VII CERTIFICATION (Continued)

B Product Inspected. (Continued)

Type: Applicant states product is sulfured sugarcane sirup.

Type: Applicant states product is unsulfured sugarcane sirup.

C Mandatory Requirements.

If the product is found to contain objectionable foreign material or filth material such as insects or insect fragments, the grade of the product should not be certified. A statement should be inserted in the body of the certificate following the word "grade" as follows:

Grade: Grade not certified account presence of foreign material (insect fragments).

D Specimen Examples of Certificates.

Attached are specimen certificates which illustrate specific examples of certification of sugarcane sirup.

Specimen No. 1

Illustrates certificate covering sulfured sugarcane sirup. The applicant requested chemical analyses for total sulfates and sulfated ash and a microscopic analysis for foreign material to satisfy buyers' specifications. The cost of these analyses is shown in the certificate. Analyses included in a normal inspection fee for sugarcane sirup are the determination of color and Brix solids. No extra charge is made for these determinations.

Specimen No. 2

Illustrates certificate covering 12 fluid ounces glass containers. The samples were officially drawn. In this illustration the net contents of the container is stated on label in terms of liquid measure.

Specimen No. 3.

Illustrates certificate covering sample submitted by applicant.

VII CERTIFICATION (Continued)

E Tolerances.

When certifying samples that have been officially drawn representing a specific lot, the grade will be determined in accordance with provisions outlined in the regulations governing inspection. In recording results of chemical analyses, consideration should be made for variations in results which are within the limits of experimental error.

SPECIMEN NO. 1

Form FV—209
(3-3-54)

ORIGINAL

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE

CERTIFICATE OF QUALITY AND CONDITION
FOR
PROCESSED FRUITS AND VEGETABLES

No. A 00001

This certificate is admissible in all courts of the United States as prima facie evidence of the truth of the statements therein contained. This certificate does not excuse failure to comply with any of the regulatory laws enforced by the United States Department of Agriculture or the Federal Food and Drug Administration.

No. A00001

Date Dec. 20, 1956 *Hour* --

To Elwood Sirup Company (Applicant) *Address* Elwood, Louisiana

Shipper or Seller -- *Address* --

Receiver or Buyer -- *Address* --

I certify that in compliance with the regulations of the Secretary of Agriculture governing the inspection and certification of the product designated herein, pursuant to the act making appropriations for the United States Department of Agriculture, I personally drew at random and inspected samples believed by me to be representative of the lot described below, and that the quality and condition as shown by the samples on the above date were as stated below:

Lot ~~or~~ ~~Car~~ No. See Remarks **Where Located** Elwood, Louisiana

Product inspected SUGARCANE SIRUP **Number, size, and kind of containers** Per Regulations

Code or other identification marks on containers S S 1 5 1 embossed on end of cans.

Principal title of label (if any) "Creole Brand Sugarcane Sirup. Packed by Elwood Sirup Company, Elwood, Louisiana. Net Weight, 2 pounds, 4 ounces."

Net weights	36-1/2 to 37-1/2 ounces
Vacuum	8 to 9 inches
Type	Sulfured
Brix Solids	74.6% Composite Sample
Sulfated Ash	5.8% Composite Sample
Total Sulfates as SO_2	92 ppm Composite Sample

Grade: U. S. GRADE A or U. S. FANCY
Score 92 to 96 Points

Remarks: Packed in plain hermetically sealed cans, neatly labeled, clean, and in good condition. Samples drawn December 18, 1956, from a lot of 1200 24/2-1/2 cans (applicant's count). Packed in solid fiber cases and located in Bay 5, Elwood Warehouse, Elwood, Louisiana, under Lot No. 1217.

Chem Anal $10.00
Micro Anal 3.00

Fee 13.00
Expenses 9.00
Total $35.00

J. L. James *Official Inspector.*
Address P. O. Box 151
Hammond, Louisiana

PLEASE REFER TO THIS CERTIFICATE BY NUMBER AND MARKET

SPECIMEN NO. 2

Form FV-147
(5-1-52)

ORIGINAL

UNITED STATES DEPARTMENT OF AGRICULTURE

PRODUCTION AND MARKETING ADMINISTRATION

CERTIFICATE OF QUALITY AND CONDITION
FOR
PROCESSED FRUITS AND VEGETABLES

No. A 0 0 0 0 2

This certificate is admissible in all courts of the United States as prima facie evidence of the truth of the statements therein contained. This certificate does not excuse failure to comply with any of the regulatory laws enforced by the United States Department of Agriculture or the Federal Food and Drug Administration.

No. A00002

Date Nov. 24, 1956 Hour --

To Dixie Sirup Company (Applicant) Address Deep South, Louisiana

Shipper or Seller -- Address --

Receiver or Buyer -- Address --

I certify that in compliance with the regulations of the Secretary of Agriculture governing the inspection and certification of the product designated herein, pursuant to the act making appropriations for the United States Department of Agriculture, I inspected the samples of the product as shown below, and that the quality and condition as shown by the samples on the above date were as follows:

Samples submitted by L. S. Boudreau, U.S.D.A. Inspector

Product inspected SUGARCANE SIRUP **Number, size, and kind of containers** Per Regulations

Code or other identification marks on containers S C 1 2 1

Principal title of label (if any) "Bayou Brand Sugarcane Sirup, Packed by Dixie Sirup Company, Deep South, Louisiana. Net Weight, 12 fluid ounces"

Net contents	12-1/2 to 13 fluid ounces
Vacuum	7 to 10 inches
Type	Unsulfured
Brix Solids	74.8% Composite

OFFICIALLY SAMPLED
NOV 23 1956
U. S. DEPT. OF AGRICULTURE
WASH., D. C.

Grade: U. S. GRADE A or U. S. FANCY
Score 92 to 94 Points

Remarks: Packed in glass jars with screw top closures, neatly labeled, clean, and in good condition. Certificate of sampling attached indicates samples drawn November 23, 1956, from a lot of 800 cases 24/12 fluid ounce glass (applicant's count) packed in corrugated fiber cases, located in Dixie Sirup Company Warehouse No. 2, Deep South, Louisiana.

Fee $13.00
Expenses --
Total $13.00

J. L. James Official Inspector.
P. O. Box 151
Address Hammond, Louisiana

PLEASE REFER TO THIS CERTIFICATE BY NUMBER AND MARKET

SPECIMEN NO. 3

Form FV-147
(5-1-52)

ORIGINAL

UNITED STATES DEPARTMENT OF AGRICULTURE

PRODUCTION AND MARKETING ADMINISTRATION

CERTIFICATE OF QUALITY AND CONDITION
FOR
PROCESSED FRUITS AND VEGETABLES

No. A 0 0 0 0 3

This certificate is admissible in all courts of the United States as prima facie evidence of the truth of the statements therein contained. This certificate does not excuse failure to comply with any of the regulatory laws enforced by the United States Department of Agriculture or the Federal Food and Drug Administration.

No. A00003

Date Dec. 23, 1956 Hour --

To Loisel Sirup Company (Applicant) Address Deep South, Louisiana

Shipper or Seller -- Address --

Receiver or Buyer -- Address --

I certify that in compliance with the regulations of the Secretary of Agriculture governing the inspection and certification of the product designated herein, pursuant to the act making appropriations for the United States Department of Agriculture, I inspected the samples of the product as shown below, and that the quality and condition as shown by the samples on the above date were as follows:

Samples submitted by Applicant

Product inspected SUGARCANE SIRUP **Number, size, and kind of containers** 6 - No. 2-1/2 cans

Code or other identification marks on containers S A 1 0 1

Principal title of label (if any) "Old Southern Brand Sugarcane Sirup, Packed by Loisel Sirup Company, Deep South, Louisiana. Net Weight, 2 pounds, 4 ounces"

Net weight range	36 to 37 ounces
Vacuum range	5 to 9 inches
Type	Unsulfured
Brix Solids	74.2% Composite Sample

Grade: U. S. GRADE B or U. S. CHOICE
Score 82 to 85 points

THE ABOVE STATEMENT IS THE GRADE OF UNOFFICIALLY DRAWN SAMPLE SUBMITTED BY THE APPLICANT.

Remarks: Packed in plain friction top cans, neatly labeled, clean, and in good condition. Samples not officially drawn.

Fee $6.00

Expenses --

Total $6.00

Official Inspector.

J. L. James
P. O. Box 151
Address Hammond, Louisiana

PLEASE REFER TO THIS CERTIFICATE BY NUMBER AND MARKET

VIII INSPECTION DURING PRODUCTION AND PACKING OPERATIONS

A General.

All applicable instructions in connection with continuous inspection and plant inspection pack grading should be followed. The requirements for plants operating under continuous inspection as outlined in the regulations should be observed.

1 Raw stock.

The quality and condition of the sugarcane, whether properly topped and stripped, should be noted, as well as whether it has been frozen, fermented, or infested by borers or insects.

2 Sanitation.

Tanks, pipe lines, and evaporating pans and other equipment for handling juice and sirup should be washed at the end of the day's run and should be maintained in a clean and sanitary condition.

3 Milling.

The milling operation should be carefully checked. The crushing rolls should be properly adjusted for maximum efficiency. The cane should be thoroughly disintegrated. A little maceration water may be used on the rollers to aid extraction. Mill sanitation should be observed to prevent the accumulation of material which may become fermented and a source of contamination of the juice. Proper attention should be given to cleanliness and sanitation around the mills. A small amount of sour bagasse can infect all of the juice with which it comes in contact.

4 Straining.

The juice, as it comes from the mills, passes through coarse and then fine strainers to remove particles of bagasse fiber. All parts of the strainers should be frequently cleaned and steamed to keep them in a thoroughly sanitary condition.

VIII INSPECTION DURING PRODUCTION AND PACKING OPERATIONS (Continued)

A General. (Continued)

5 Reaction of cane juice.

The hydrogen ion concentration (pH) of the juice may vary considerably but has been found to fall within narrow limits in a given location. Louisiana crusher juice in some years has averaged 5.38 pH with a range of 5.22 to 5.63 pH for individual samples. The pH value has not been found to be suitable for determining maturity of the cane, extent of souring, or damage due to freezing. A wide difference from the normal average pH should be investigated. The acid in fermented juice is largely acetic which is volatile. The normal acidity of juice is due to the presence of non-volatile acid. If an excess acidity is indicated, 100 ml of the juice is placed in a distillation flask and the first 25 ml of distillate is titrated with 0.1N alkali solution. Excess acidity of less than 1.0 ml can be detected by this method.

6 Methods of production.

a Unsulfured sirup.

In the production of unsulfured sirup the "boil and skim" method of production is widely used. The cane may be crushed in a single three-roller mill. The juice is strained and run into the clarifier and evaporator which is usually direct fired. The juice is clarified simply by heating. The albuminoids in the juice are coagulated by heating and rise to the surface where the scum is removed by sweeps or scoops made from metal screening or perforated metal. The brushing and screening continue constantly during evaporation to the required density.

b Sulfured sirup.

In the production of sulfured sirup the "sulfitation process" is used. This process is used by the larger plants with production capacity of several thousand gallons of sirup per day. The cane is usually milled by first passing through a crusher and then through six or more rollers on which a little maceration water is used to aid extraction of the juice. The juice is strained and saturated with sulfur

VIII INSPECTION DURING PRODUCTION AND PACKING OPERATIONS (Continued)

A General. (Continued)

6 Methods of production. (Continued)

b Sulfured sirup. (Continued)

dioxide to an acidity of 3.5 to 4.00 cc after which the acidity is reduced to 0.8 to 1.0 cc by the addition of milk of lime. The juice is then brought to a boil and the "mud" then allowed to settle out. The clear juice is decanted or piped to open evaporators where the juice is evaporated under vacuum to about 50° Brix and again allowed to settle. The clear semi-sirup is further concentrated in open evaporators to the required consistency. A large part of sulfited sirup is sold in bulk for blending with molasses or glucose for table use and cooking.

7 Blending.

Sirup which is obtained from different producers may vary considerably in color and flavor as well as in other respects. Such sirups may be blended in order to maintain a uniform quality product under a producer's or distributor's label. A considerable amount of experience is required in the blending of sirups. A careful grading and analysis of each component is helpful in determining the quantities of each of several different lots of sirup which should be used in making a blend. Usually the final selection of sirups for a blend is made by one individual who is thoroughly familiar with the requirements of the product and has become proficient in selecting suitable stock for blending through many years of experience.

8 Filling.

The temperature of filling is usually sufficient for sterilization without any additional heat treatment. The rate of cooling must be taken into account in this connection. When the product is air cooled, higher processing temperatures may be necessary for sterilization during the winter months than during the warm summer months. The following processing

VIII INSPECTION DURING PRODUCTION AND PACKING OPERATIONS (Continued)

A General. (Continued)

8 Filling. (Continued)

and filling temperatures are suggested for sugarcane sirup in the can sizes indicated when the cans are labeled from the line, cased in fiber cases, and air cooled:

Can size	Processing temperature Degrees F.	Filling temperature Degrees F.
No. 2	187	177
No. 2-1/2	187	177
No. 10	170	160

The above temperatures are suggested only and may serve as a guide in establishing filling temperatures which will be adequate under the particular conditions encountered. All containers should be adequately code marked for identification at time of filling.

The container should be filled with sirup as full as practicable in accordance with good commercial practice. This means that the headspace should not be excessive. Cans having excessive headspace will be considered to be slack filled regardless of whether the quantity in the container agrees with the label statement of net contents. As a guide in avoiding slack fill, the container should be filled to not less than 93 percent of its total capacity. Frequent inspection should be made in order to make sure that the headspace is not excessive. If there is any question as to whether the headspace may be excessive, it should be measured by means of a headspace gauge. The maximum allowable headspace for the various sizes of sanitary type cans in general use is given in the following list:

Sanitary Type Cans
(Measured from top of double seam)

Can name	Dimensions	Maximum headspace Sixteenths of an inch
No. 1 Picnic	211 x 400	7.0
No. 300	300 x 407	7.5
No. 303	303 x 406	7.5
No. 2	307 x 409	7.7
No. 2-1/2	401 x 411	7.8
No. 10	603 x 700	10.4

VIII INSPECTION DURING PRODUCTION AND PACKING OPERATIONS (Continued)

A General. (Continued)

8 Filling. (Continued)

It should be pointed out that the maximum headspace indicated is greater than will be found in well filled cans.

9 Cooling.

After filling, the cans should pass through a spray of water to wash off any adhering sirup. Cans should be sufficiently cooled before labeling, casing, and warehousing to prevent caramelization which may adversely affect both the color and the flavor of the sirup.

10 Warehousing.

During the summer months cases may be open stacked to permit quicker cooling of the product and lessen the possibility of "stack-burn," and loss of color. External corrosion of the container may occur when canned foods are stored in damp warehouse space, or if moisture condenses on the surface of the container from the surrounding air. Canned foods stored in warehouses should be protected from sudden changes in temperature which may cause "sweating." Even a slight degree of rusting causes the cans to become unsightly in appearance, and loose and discolored labels may result in unmerchantable containers.

Cases in storage should be examined frequently for evidence of corrosion and spoilage.

11 Labeling.

All labels must show the name of the product, the net contents of the container, and the name and address of the processor, packer, or distributor. When the product is not manufactured by the distributor the name of the distributor must be qualified by the statement, "Manufactured for," "Packed for," or "Distributed by," or some similar expression.

VIII INSPECTION DURING PRODUCTION AND PACKING OPERATIONS (Continued)

A General. (Continued)

11 Labeling. (Continued)

The statement of net contents is expressed in terms generally used to express the quantity of the product in the container and to give the consumer accurate information on the amount. In general, the statement of net contents should be in terms of liquid measure for liquid products or in terms of weight if the food is solid, semisolid, viscous, or a mixture of solid and liquid. If desired, a statement of net contents in terms of both liquid measure and weight may be used. In either case, the statement of quantity should be in terms of the largest unit of weight or measure. For example, instead of 24 ounces the statement should be "1-1/2 pounds" or "1 pound, 8 ounces." The statement of weight or measure may be supplemented by a statement in terms of the metric system of weight or measure.

The brand name, as well as information on the quality of the product, may appear on the label together with other appropriate material. Label statements should not be false or misleading in any particular.

The labeling provisions of the Food, Drug, and Cosmetic Act are under the jurisdiction of the Food and Drug Administration, Department of Health, Education, and Welfare. When questions arise concerning labeling of the product, the matter should be referred to your supervisor.

12 Recommendations.

Daily reports should be prepared and promptly issued to the company official designated to receive them. A written report, in addition to the daily report, to cover special situations, may be necessary when an unsatisfactory condition is not promptly corrected. The inspector should endeavor to make recommendations to the management which will be helpful in maintaining adequate control of quality. The inspector should consult his supervisor for advice if any unusual situation should develop. Suggestions should be made to the management whenever the opportunity is presented for improving quality and overcoming objectionable conditions.

IX DEFINITIONS AND METHODS OF ANALYSIS

A Brix Solids.

The double-dilution method for determining Brix solids by means of a Brix spindle is preferred and should be used in the event there may be some controversy in regard to results in the Brix determination. If desired, the Brix determination may also be made on the undiluted sample. In offices supplied with a refractometer, the refractometric method may be used. This is perhaps the most convenient method of determining Brix, however, lower results are obtained by the refractometer than by the double-dilution method. For this reason the double-dilution method should be used if there is a possibility that a controversy may arise regarding the results of the Brix determination, or in any case where the degrees Brix are on the borderline of minimum requirements for the grade.

Sirup containing sugar crystals should be liquified by heating to approximately 54.4° C. (130° F.) and cooled to approximately 20° C. (68° F.) or to room temperature before making Brix determinations.

1 Double-dilution method.

Pour approximately 250 grams of sirup into one liter beaker and pour an equal weight of distilled water into a second liter beaker. Mix the two completely by pouring alternately from one beaker into the other several times. Pour the double-diluted sirup into a hydrometer cylinder and place a clean, dry Brix hydrometer of the necessary range (31° - 41°) in the sirup, being careful not to immerse the hydrometer too deeply and making certain that the hydrometer does not touch the cylinder wall. Allow to stand 15-30 minutes to permit air bubbles to escape. Take temperature of sirup in cylinder at the time the Brix reading is taken. Multiply reading by two and apply temperature correction to obtain Brix degree of sirup.

2 Direct spindle method.

Pour well mixed sirup sample in cylinder and take Brix as described above except that 45-60 minutes should be allowed before Brix reading is taken. It is desirable to have sirup samples at or close to room temperature before making Brix determinations by spindle. Apply temperature corrections to spindle readings found in Table No. 3.

IX DEFINITIONS AND METHODS OF ANALYSIS (Continued)

A Brix Solids. (Continued)

3 Refractometric method.

Determine refractometer reading of sirup at 20° C. (68° F.) and obtain the corresponding percent of sucrose from the direct reading if the refractometer is provided with a sugar scale, or by referring to Table No. 1 if the refractometer reading is in terms of refractive index. If the reading is made at a temperature other than 20° C., appropriate temperature correction should be applied as given in Table No. 2.

B Total Sugars.

1 Reducing sugars.

Reducing sugars are determined by the Lane-Eynon method as follows:

Soxhlet modification of Fehling solution. This solution is prepared by mixing immediately before using equal volumes of the following solutions a and b:

a Copper sulfate solution. Dissolve 34.639 grams of copper sulfate $CuSO_4.5\ H_2O$ in distilled water and dilute to exactly 500 ml and filter through prepared asbestos.

b Alkaline tartrate solution. Dissolve 173 grams of Rochelle salts (sodium potassium tartrate) and 50 grams of sodium hydroxide in water, dilute to 500 ml, allow to stand for two days, and filter through prepared asbestos. If pure chemicals are used in the preparation of the above solutions a and b, filtration may not be necessary.

c Standard invert sugar solution.

Dissolve 9.5 grams of pure sucrose (high grade large grain granulated sugar) in a small amount of water, add 5 ml of hydrochloric acid (sp. gr. 1.19), and dilute with water to about 100 ml and let stand at room temperature for 3 days at 20° to 25° C., then dilute to 1 L. This acidified 1 percent invert sugar solution is stable over a period of several months. Immediately before using, the amount required

IX DEFINITIONS AND METHODS OF ANALYSIS (Continued)

B Total Sugars. (Continued)

1 Reducing Sugars. (Continued)

c Standard invert sugar solution. (Continued)

is neutralized with NaOH and diluted to the desired concentration immediately prior to use.

Standard invert sugar solution can also be made by dissolving 1 gram of pure dextrose (NBS Standard or C. P. quality) in about 100 ml of water. Transfer to 500 ml flask and make up to volume with distilled water. 1 ml of this solution = 2 milligrams of dextrose.

d Methylene blue indicator.

Dissolve 1 gram of methylene blue in distilled water and make up 100 ml. This solution is quite stable and will keep for months without change.

e Standardization and titration.

Pipet accurately 25 ml of mixed Soxhlet solution (equal parts of Soxhlet solutions a and b) into a 300-400 ml flask. Carefully neutralize 50 ml of the standard invert sugar solution c in a 100 ml flask with NaOH and make up to volume by the addition of distilled water. Approximately 24.5 ml of this solution should reduce all of the copper in 25 ml of the Soxhlet solution. Add approximately 23.5 ml of the standard solution from burette to the Soxhlet solution. Heat the cold mixture to boiling on a wire gauze over Bunsen flame or hot plate and maintain in moderate ebullition for 2 minutes, lowering temperature sufficiently to avoid bumping. Without removing from hot plate add 2 to 5 drops of methylene blue indicator and complete titration within total boiling time of about 3 minutes by small additions of sugar solution from burette to complete decoloration of indicator.

A small electric hot plate (provided with a wire gauze) connected to a rheostat (powerstat) to control the heat is convenient to use and permits close control of ebullition. When the rheostat is set at 130 on the dial, boiling occurs in 30-45 seconds. The temperature can then be lowered by reducing the dial setting on the rheostat to about 100 to maintain moderate ebullition. Add methylene blue and bulk of sugar solution within 105 seconds after boiling begins. The temperature should be

IX DEFINITIONS AND METHODS OF ANALYSIS (Continued)

B Total Sugars. (Continued)

1 Reducing sugars. (Continued)

e Standardization and titration. (Continued)

increased as necessary to maintain boiling, increasing rheostat setting to about 130 on dial. With a swirling motion of flask complete titration within the final 60 seconds, adding a drop or two of methylene blue as needed for sharp end point. Multiply the number of ml of sugar solution (4.75 mg) to obtain the factor. Compare with factor in Table No. 5 to determine correction, if any, to be applied to table. Small deviations from tabulated factors as given in the table may result from variations in individual procedure or composition of reagents. When only approximate results (within 1%) are desired, the standardized procedure may be omitted, provided specifications of analysis are rigidly observed.

f Determination of reducing sugars.

For total sugars, ash, and sulfite determinations prepare a composite sample by mixing together about 200 grams of the well mixed sample and make up to 500 ml in volumetric flask. If approximate concentration of sugar in sample is unknown, a preliminary titration by the incremental method of titration is usually necessary, as follows: Add to 10 or 25 ml of Soxhlet solution 15 ml of the sugar solution from burette and heat to boiling over wire gauze if gas flame is used, or on hot plate. Boil about 15 seconds and add rapidly further quantities of the sugar solution until only the faintest perceptible blue color remains. Then add 2-5 drops of methylene blue and complete titration by adding the sugar solution dropwise. In adding the sugar solution to the boiling Soxhlet solution the burette should be held in the hand and brought over the flask. The burette is fitted with a small outlet tube bent twice at right angles so that the body of the burette can be kept out of the steam while the outlet tube is held over the flask. Burettes with glass stopcocks are unsuitable for this purpose. The

IX DEFINITIONS AND METHODS OF ANALYSIS (Continued)

B Total Sugars. (Continued)

1 Reducing sugars. (Continued)

f Determination of reducing sugars. (Continued)

error resulting from this titration will not generally exceed 1 percent. For greater precision repeat the titration, adding almost the entire sugar solution required to reduce all copper. Then boil for about 15 seconds and add further quantities until only a faint blue color remains. Add 2-5 drops of methylene blue indicator and complete titration. The flask should remain on wire gauze over Bunsen flame or on hot plate throughout entire titration except when it may be removed for a few seconds and held against a sheet of white paper to ascertain if the end point has been reached. The edge of the liquid will appear bluish if the indicator is not completely decolorized. Find factor in Table No. 4 or Table No. 5 corresponding to titer (number cc used for titration) and apply correction previously determined. Estimate as follows:

Factor x 100 ÷ titer = mg of sugar in 100 ml of sugar solution.

Example: 40 ml of sugar solution required for titration -

Factor from table	-- 124.8
Correction from standardization	-- +6.0
Corrected factor	-- 130.8

130.8 x 100 ÷ 40 = 327 mg reducing sugars per 100 ml of sample
100 ml of sample solution = 1 gram sample
Reducing sugars = 32.7%

IX DEFINITIONS AND METHODS OF ANALYSIS (Continued)

B Total Sugars. (Continued)

1 Reducing sugars. (Continued)

g Determination of reducing sugars - optional method.

The following method may be used for routine inspections. Reducing sugars are determined by the Lane-Eynon method as follows:

Weigh 50 grams of double-diluted sirup from Brix determination and transfer to a 250 ml volumetric flask. Add 3.5 to 5.0 ml of a saturated solution of neutral lead acetate ($PbAc_2.3H_2O$) solution and dilute to 250 ml. Mix well and pour through a folded filter on which has been placed about 1 teaspoon full of a filter aid (Kieselguhr or diatomaceous earth, Super Cel, Filter Cel). Reject the first 25 ml of filtrate. Add a small quantity of deleading agent (made by mixing 70 grams of disodium phosphate and 30 grams of potassium oxalate dry) to the filtered solution and pour through a second folded filter paper after mixing. Again reject the first 25 ml of filtrate and reserve the remainder for both reducing sugar and sucrose determination. Pipet 25 ml of the filtrate (second filtrate above) into a 250 ml volumetric flask and make up to 250 ml with distilled water. This solution is usually of sufficient strength to titrate 10 ml of the mixed Fehlings solution. The titration varies with the amount of reducing sugar and can be determined by trial. Titrate as directed under 1 f above.

h Calculations for reducing sugars.

Calculations for reducing sugars using above dilutions:

IX DEFINITIONS AND METHODS OF ANALYSIS (Continued)

B Total Sugars. (Continued)

1 Reducing sugars. (Continued)

h Calculations for reducing sugars. (Continued)

Titration (titer)	(1st)	27.56 ml prepared sugar solution required to reduce 10 ml Fehlings solution.
	(2nd)	27.60 ml prepared sugar solution required to reduce 10 ml Fehlings solution.
Average of two titrations		27.58 ml prepared sugar solution required to reduce 10 ml Fehlings solution.

Factor: 51.0

Obtain factor corresponding to titer of 28 from Table No. 4 corrected for approximately 50 percent sucrose. At this particular dilution this corresponds to 0.5 grams of sucrose per 100 ml of solution. Interpolate between column under heading "1 Gm Sucrose per 100 Ml Invert Sugar" and column under heading "Invert Sugar - No Sucrose."

51.4 - 50.5 = 0.9; 0.9 x 0.5 = 0.45 correction to be applied to 51.4, gives corrected factor = 51.0

50 grams of double diluted sirup diluted to 250 ml
25 ml of this solution is diluted to 250 ml
1 ml of final dilution = 0.01 gram in original sample

$$\frac{51.0 \times 100}{27.58 \times 0.01 \times 1000 \text{ mgs}} = \frac{51.0}{27.58} \times 10 = 18.49 \text{ percent reducing sugar.}$$

10 is the factor to convert to percent sample basis for this particular dilution. Other dilutions will require a different factor depending upon the weight of the sample taken.

IX DEFINITIONS AND METHODS OF ANALYSIS (Continued)

B Total Sugars. (Continued)

2 Sucrose.

Sucrose may be determined by one of the following methods:

By polarization before and after inversion with invertase (official).

By Jackson-Gillis Clerget Modification (Method 4).

By titration before and after inversion using Fehlings solution.

a Sucrose by polarization method (1).

i Invertase solution.

Use commercially prepared invertase solution. The activity of the invertase solution is determined as follows:

Dilute 1 ml of the invertase preparation to 200 ml. Transfer 10 grams of sucrose (high grade large grain granulated sugar) to a sugar flask graduated at 100 ml and 110 ml, and dissolve in about 76 ml of distilled water. Add 2 drops of acetic acid and dilute to the 100 ml mark. To the 100 ml of sugar solution add 10 ml of the diluted invertase solution and mix thoroughly and rapidly, noting the exact time at which the solutions are mixed. At the termination of exactly 60 minutes make a portion of the solution just distinctly alkaline to litmus paper with sodium carbonate (Na_2CO_3O) and polarize in a 200 mm tube at 20° C. If the invertase solution is sufficiently active the alkaline solution will polarize about 31° S without correcting for dilution to 110 ml and the optical activity of the invertase solution.

IX DEFINITIONS AND METHODS OF ANALYSIS (Continued)

B Total Sugars. (Continued)

2 Sucrose. (Continued)

a Sucrose by polarization method (1). (Continued)

ii Basic lead acetate solution.

Heat to boiling for about half an hour 430 grams of neutral lead acetate and 130 grams of litharge in one liter of water. Cool, settle, and decant the clear solution. Dilute the solution with cold, recently boiled, distilled water to 1.25 sp. gr. (54.3 degrees on Brix hydrometer). The solution may also be made by dissolving the reagent known as Horne's dry lead in recently boiled, distilled water to a density of about 1.25 sp. gr. (54.3 degrees on Brix hydrometer). Lead subacetate solution stored in stock bottles for daily use should be protected from the carbon dioxide in the air by soda-lime tubes. The burettes used for dispensing for routine analyses should be similarly protected.

iii Alumnia cream, aluminum hydroxide.

To a saturated solution of aluminum in water add ammonium hydroxide (NH_4OH) with constant stirring until the solution is alkaline to litmus paper. Allow precipitate to settle and wash by decantation with water until wash water gives only a slight test for sulfates with barium chloride ($BaCl_2$) solution. Pour off excess water and store residual cream in a stoppered bottle. Alumnia cream is suitable for clarifying light colored sugar products or as an adjunct to other agents when sugars are determined by polariscopic or reducing sugar methods.

iv Determination.

Dissolve double the normal weight (52 grams) of sugarcane sirup in water in a 200 ml flask; add basic lead acetate solution carefully, avoiding any excess, then 1 to 2 ml of alumnia cream; shake; dilute to mark with water; mix well; and filter, rejecting at least the first 25 ml of filtrate. When sufficient filtrate has collected, remove the lead from the solution by

IX DEFINITIONS AND METHODS OF ANALYSIS (Continued)

B Total Sugars. (Continued)

2 Sucrose. (Continued)

a Sucrose by polarization method (1). (Continued)

iv Determination. (Continued)

adding anhydrous sodium carbonate, a little at a time, avoiding any excess; mix well; filter again, rejecting at least the first 25 ml of the filtrate. (Instead of weighing 52 grams into a 200 ml flask, two 26-gram portions may be diluted to 100 ml each and treated exactly as described. Depending upon the color of the product, multiples or fractions of the normal weight may be used, and the results reduced by calculation to the basis of 26 grams in 100 ml.) Pipet one 50-ml portion of the lead-free filtrate into a 100-ml flask, dilute with water to the mark; mix well; and polarize in a 200 mm tube. The result, multiplied by 2, is the direct reading (P of formula given below) or polarization before inversion. A 400 mm tube may be used, in which case the direct reading as taken equals P.

v Invert reading.

First determine the quantity of acetic acid necessary to render 50 ml of the lead-free filtrate distinctly acid to methyl red indication; then to another 50 ml of the lead-free solution in a 100 ml volumetric flask add the requisite quantity of acid and 5 ml of the invertase preparation. Fill the flask with water nearly to the 100 ml mark and let stand overnight, preferably at a temperature of not less than 20° C. Cool and dilute to 100 ml at 20° C. Mix well and polarize at 20° C. in a 200 mm tube. If in doubt as to completion of hydrolysis, allow a portion of the solution to remain for several hours and again polarize. If there is no change in the previous reading, the inversion is complete. Carefully note the reading and temperature of the solution. If it is necessary to work at a temperature other than 20° C., which is permissible within narrow limits, the solutions must be made up to volume and both direct and invert readings must be made at the

IX DEFINITIONS AND METHODS OF ANALYSIS (Continued)

B Total Sugars. (Continued)

2 Sucrose. (Continued)

a Sucrose by polarization method (1). (Continued)

v Invert reading. (Continued)

same temperature. Correct the invert reading for the optical activity of the invertase solution and multiply by 2.

vi Calculations.

Calculate the percentage of sucrose by the following formula:

$$S = \frac{100\ (P - I)}{132 + 0.073\ (M - 13) - 0.5\ (T - 20)}$$

in which S = percentage of sucrose
P = direct reading, normal solution
I = invert reading, normal solution
T = temperature at which readings are made
M = grams of total solids in 100 ml of the invert solution read in the polariscope. Percent solids by refractometer multiplied by specific gravity of the solution gives grams of total solids.

b Sucrose by Jackson-Gillis Clerget modification.

i Preparation of normal solution.

Prepare a normal solution by weighing out 52 grams of sugarcane sirup, wash into a 300 ml volumetric flask, make up to mark and mix thoroughly. Pour the solution out into a cylinder (capacity 400 to 500 ml) and add sufficient Horne's dry lead to clarify, avoiding an excess (4 to 6 grams are usually sufficient). Mix by violent shaking and filter. Pipet two 50 ml portions of the filtrate into 2 100 ml flasks and add 20 ml of water to each flask.

IX DEFINITIONS AND METHODS OF ANALYSIS (Continued)

B Total Sugars. (Continued)

2 Sucrose. (Continued)

b Sucrose by Jackson-Gillis Clerget modification. (Continued)

ii Polarization before inversion.

To one portion add 10 ml of a solution of sodium chloride containing 231.5 grams per liter. Make up to volume with distilled water at the temperature at which the observations are to be made and polarize in a water jacketed tube. The reading calculated to a normal weight basis = P.

iii Polarization after inversion.

To the other 50 ml portion of the filtrate add 2 ml of hydrochloric acid (sp. gr. 1.1029 at $20^{\circ}/4^{\circ}$ C.) to the cold solution. Insert a thermometer in the flask and heat by immersing in a hot water bath until the temperature is exactly 65° C. Remove the flask from the bath, add 10 ml of hydrochloric acid, mix by rotating, and set aside for thirty minutes. Longer standing does not affect the results. Cool and make to volume at the temperature at which the observations are to be made. If the solution is too dark colored it may be treated with successive small amounts of pure metallic zinc dust. The coloring matter is destroyed by the nascent hydrogen. No more zinc than is necessary should be used. Make the polarization in a water jacketed tube with the temperature carefully regulated to the same as that for direct polarization. The reading calculated to normal weight basis = - P'. Polariscopic reading (both direct and invert) should be the average of several concordant observations. Multiply these average readings by 6 to obtain the values for P and P'.

The Walker method of inversion described above may be insufficient to cause complete inversion in low purity products (final molasses) in cool weather when cooling may be rapid.

IX DEFINITIONS AND METHODS OF ANALYSIS (Continued)

B Total Sugars. (Continued)

2 Sucrose. (Continued)

b Sucrose by Jackson-Gillis Clerget modification. (Continued)

iii Polarization after inversion. (Continued)

If time permits, the inversion may be carried out at room temperature. The AOAC recommends 24 hours if the inversion is not below 20° C. and 10 hours if it is above 25° C., but for low purity products such as molasses and even for raw sugars a few hours longer at these temperatures are needed to insure complete inversion. As the 24-hour period is usually the most convenient, inversion may be assured in this period by placing the flask in a warm place in the laboratory.

The U. S. Customs Regulations prescribe inversion as follows: Immerse the flask in a water bath at exactly 60° C. Agitate the solution continually for 3 minutes and allow it to remain in the bath for a total time of 10 minutes. Cool quickly and make to volume at the temperature at which the observations are to be made. Shake and filter as rapidly as possible. Polarize.

iv Calculations.

Calculate the sucrose as follows:

The Jackson-Gillis method (4) as adopted by the U. S. Treasury Department and the International Commission for uniform methods employs a table for the values of the Clerget divisor, as given in Table No. 6, based on the volume of P - P', i.e., the sucrose concentration. When the Walker method in inversion is used, the sucrose may be calculated by the following formula:

$$S = \frac{100\,(P - P')}{132.63 + 0.0794\,(M - 13) - 0.53\,(T - 20)}$$

IX DEFINITIONS AND METHODS OF ANALYSIS (Continued)

B Total Sugars. (Continued)

2 Sucrose. (Continued)

b Sucrose by Jackson-Gillis Clerget modification. (Continued)

iv Calculations. (Continued)

For 60° inversion the basic value is 132.56 instead of 132.63, and for room temperature inversion the basic value is 132.66. Polariscopic readings (both direct and invert) should be the average of several concordant observations. Multiply these average readings by 6 to obtain the values for P and P'.

In the above formula P - P' are the direct and invert readings (average of several readings) multiplied by 6, M is the grams of solids in 100 ml of the solution and 0.53 (T - 20°) is the temperature correction. For sugarcane sirup of usual density the calculation 132.63 + 0.0794 (M - 13) may be dispensed with and the figure 131.88 may be used without appreciable error. The temperature correction 0.53 (T - 20) can be calculated or may be obtained from Table No. 6.

Example:

Direct reading	+ 5.6x6 =	33.6 (P)
Reading after inversion	- 2.3x6 =	- 13.8 (P')
		47.4 (P - P')

Temperature = 24.3° C.

Factor	131.88
Temperature correction (from table)	2.28
	129.60

$$\text{Sucrose} = \frac{47.4}{129.60} \times 100 = 36.57$$

IX DEFINITIONS AND METHODS OF ANALYSIS (Continued)

B Total Sugars. (Continued)

2 Sucrose. (Continued)

c Sucrose by volumetric method, Lane-Eynon (for routine inspections).

The following method may be used for routine inspections. Sucrose is calculated after inversion with invertase by the Lane-Eynon method as follows:

i Preparation of invert solution.

Pipet 10 ml of the prepared solution of sugarcane sirup, as used in determining reducing sugar in 1 g above, into a 250 ml volumetric flask and add 5 ml of invertase solution. The invertase solution is made by dissolving 1 gram of Wallerstein Blue Label dry invertase in distilled water and make up to 100 ml. (Other invertase preparations are available and may be used.) After adding the invertase solution to the prepared sugarcane sirup solution, add 5-6 drops of glacial, acetic acid, mix well and place in a hot water bath or on a hot plate, so adjusted that the temperature is kept at 55° to 60° C. for one hour, or leave at room temperature (not below 20° C.) for 24 hours. After one hour of heating (hot water bath or hot plate) at 55° to 60° C., cool flask to about 20° C. and make up to 250 ml. Carefully neutralize to litmus paper with anhydrous sodium carbonate, and then titrate using 10 ml of mixed Fehlings solution. Titrate as directed under 1 f above.

IX DEFINITIONS AND METHODS OF ANALYSIS (Continued)

B Total Sugars. (Continued)

2 Sucrose. (Continued)

c Sucrose by volumetric method, Lane-Eynon (for routine inspections). (Continued)

ii Calculations.

Calculations using the above dilutions:

Titration (titer)	(1st)	17.38 ml prepared sample solution required to reduce 10 ml Fehlings solution
	(2nd)	17.42 ml prepared sample solution required to reduce 10 ml Fehlings solution
Average of two titrations		17.40 ml prepared sample solution required to reduce 10 ml Fehlings solution

Factor: 50.7

Obtain factor corresponding to titer from Table No. 4, first column, headed "Invert Sugar - No Sucrose."

From 1 f - 0.008 gram original sample in 1 ml double diluted sample = 0.004 gram original sample.

$$\frac{50.7 \times 100}{17.40 \times 0.004 \times 1000} = \frac{50.7}{17.40} \times 25 = 72.825\%$$ reducing sugar and sucrose as reducing sugar.

25 is the factor to convert total sugars to percent sample basis this dilution.

72.825 - 18.490% reducing sugar at same dilution = 54.335% sucrose as invert sugar.

IX DEFINITIONS AND METHODS OF ANALYSIS (Continued)

B Total Sugars. (Continued)

2 Sucrose. (Continued)

c Sucrose by volumetric method, Lane-Eynon (for routine inspections). (Continued)

ii Calculations. (Continued)

54.335 x 0.95 = 51.62% sucrose.

0.95 is the factor to convert invert sugar to sucrose.

d Sucrose by volumetric method, Lane-Eynon (alternate method).

Determine reducing sugars before and after inversion with HCl. Dry sodium oxalate should be added to the prepared solution at the rate of 0.5 gram per 500 ml and clarified with neutral lead acetate. The solution is then filtered. A small amount of Kieselguhr may be added as an aid to filtering. After filtration, proceed as outlined under 1 f Calculate as invert sugar.

i Inversion.

Invert the solution as follows: Pipet a 50 ml portion of lead free filtrate into a 100 ml flask and add 25 ml of water. Add a little at a time while rotating flask 10 ml of hydrochloric acid (sp. gr. 1.1029 at 20/4° or 24.95° on Brix hydrometer at 20° C.). Place the flask with thermometer inserted in a water bath at 70° C. and regulate temperature at about that point. Agitate the flask continuously until contents reach a temperature of 67° C. This preliminary heating should require about 2-1/2 to 2-3/4 minutes. When the thermometer in the flask indicates 67° C., leave flask in bath for exactly 5 minutes longer, during which time the temperature should gradually rise to about 69.5° C. At the end of the 5 minute period place the flask immediately in water at about 20° C. When the contents have cooled to about 35° C., remove the thermometer, rinsing the solution from the thermometer into the flask, and fill almost

IX DEFINITIONS AND METHODS OF ANALYSIS (Continued)

B Total Sugars. (Continued)

2 Sucrose. (Continued)

d Sucrose by volumetric method, Lane-Eynon (alternate method). (Continued)

i Inversion. (Continued)

to mark. Leave flask in bath at 20° C. at least 30 minutes longer and finally make to exact volume and mix well. Exactly neutralize the acid and again determine the reducing sugars, calculating to invert sugar, using invert sugar column alone as given in Table No. 4 or Table No. 5. Deduct the percent of invert sugar obtained from inversion from that obtained after inversion and multiply the difference by 0.95 to obtain the percent of sucrose. The solutions used in both determinations should be diluted so that not more than 230 milligrams of invert sugar is present in the quantity required for reduction. It is important that all lead be removed from the solution with dry sodium oxalate before reduction.

ii Calculation.

Use Table No. 4 if 10 ml of copper solution has been used and Table No. 5 if 25 ml of copper solution has been used. Under the proper column heading for the amount of sucrose present in 100 ml of the solution tested and opposite the milliliters of solution required to precipitate the copper as found by titration (titer) is the invert sugar factor. The amount of invert sugar in 100 ml of the test solution is the factor times 100 titer which is calculated in the column opposite the factor.

IX DEFINITIONS AND METHODS OF ANALYSIS (Continued)

B Total Sugars. (Continued)

2 Sucrose. (Continued)

d Sucrose by volumetric method, Lane-Eynon (alternate method). (Continued)

ii Calculation. (Continued)

Example: A solution containing 5 grams of sucrose per 100 ml required 28 ml to reduce 10 ml of Soxhlet solution. The factor from Table No. 4 is 47.7.

$$4.7 \times \frac{100}{28} = 170.3$$

This is the number of milligrams of invert sugar in 100 ml of the test solution, which is the amount shown corresponding to the factor. These are the calculations which have been carried out in computing the table. Fractions of a milliliter may be interpolated.

C Total Sugars, Calculations.

The total sugars present in the sugarcane sirup is the sum of the percent of reducing sugars in the percent of sucrose as determined in the methods herein prescribed.

D Ratio of Total Sugars to Brix Solids.

Multiply the percent of total sugars by 100 and divide by the Brix. Express the results as percent.

1 Calculations.

$$\frac{70.0 \times 100}{75} = 93.3\%$$ ratio of total sugars to Brix solids.

IX DEFINITIONS AND METHODS OF ANALYSIS (Continued)

E Sulfated Ash.

Weigh 5 grams of sample into a 50-100 ml platinum dish (silica dish may be used in place of platinum), add 5 ml of 10 percent sulfuric acid (H_2SO_4) and ignite until sample is well carbonized, and then burn in a muffle furnace at about 550° C., cool, add 2-3 ml of 10 percent sulfuric acid and evaporate on a steam bath, then to dryness on a hot plate, and again ignite at about 550° C. to constant weight. Express result as percent sulfated ash.

1 Sulfated ash (alternate method).

The following alternate method may be used and is recommended for making routine ash determinations:

Weigh approximately 10 grams of double diluted sample into a platinum dish (silica dish may be used in place of platinum), add 5 ml of 10 percent sulfuric acid (or several drops of concentrated sulfuric acid) and char carefully under an infra-red lamp (it requires approximately 30 minutes). Heat in a muffle furnace at 550° C. Remove, cool, and add 2-3 ml of 10 percent sulfuric acid and evaporate to dryness under infra-red lamp. Reheat to constant weight in a muffle furnace at 550° C. (The commercially available 250-watt infra-red lamps are suitable for evaporation and charring.)

F Ratio of Sulfated Ash to Brix Solids.

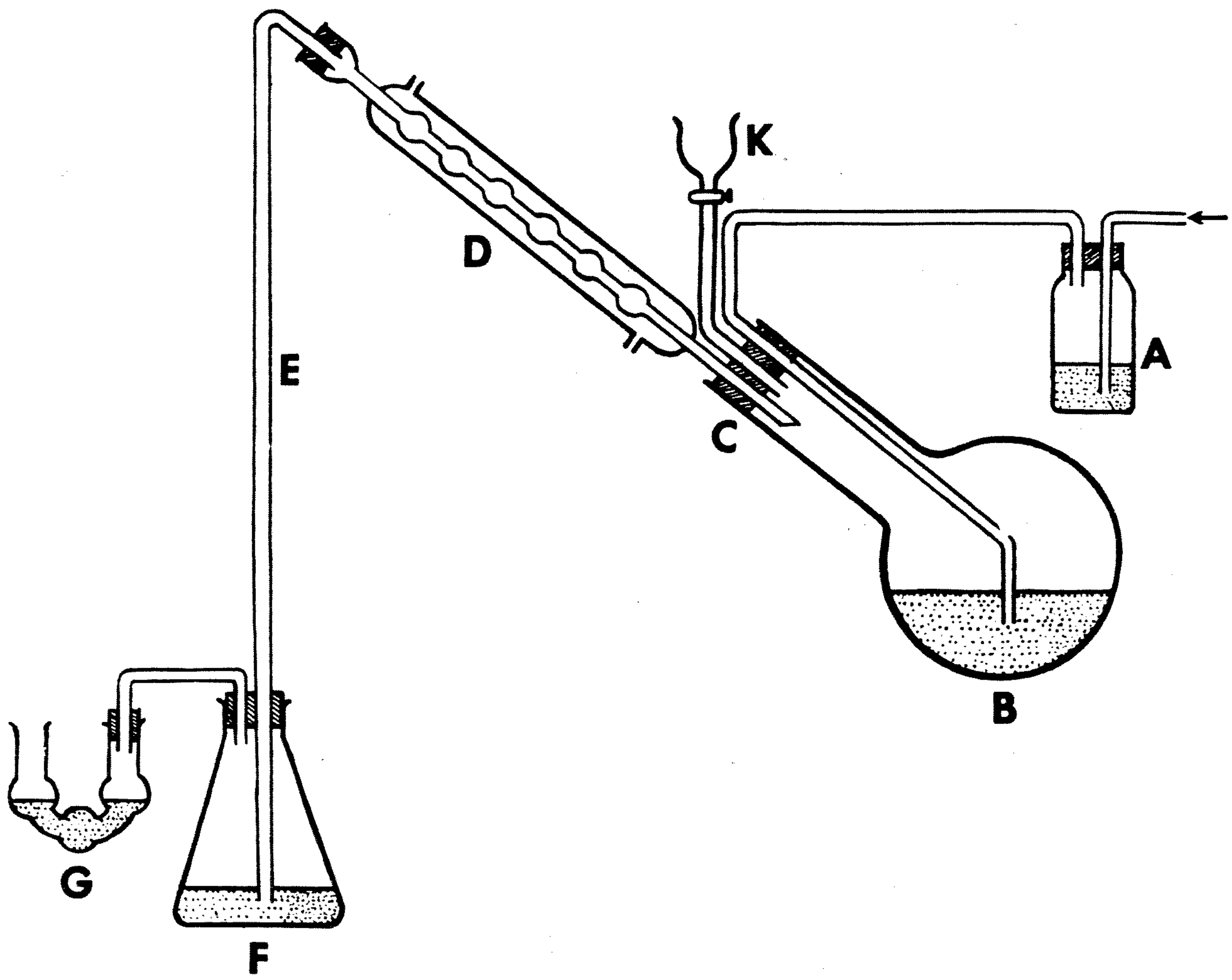
Multiply the percent of sulfated ash by 100 and divide by the Brix.

Example: Sulfated ash 1.5%
Brix 75

$$\frac{1.5 \times 100}{75} = 2.0\%$$ ratio of sulfated ash to Brix solids.

IX DEFINITIONS AND METHODS OF ANALYSIS (Continued)

G Total Sulfites; by Monier-Williams Method.



MONIER-WILLIAMS APPARATUS FOR DETERMINATION OF SULFUROUS ACID

Connect a 750 ml round bottom Pyrex flask (B) to sloping reflux condenser (D) the lower end of which is cut off at an angle. Pass CO_2 from generator through a dilute solution of sodium carbonate (Na_2CO_3) in (A) to remove chlorine. Also connect dropping funnel (K) to (B) by 3-holed stopper (C). Use tube (E) to connect upper end of condenser to 200 ml Erlenmeyer flask (F), which is followed by Peligot tube (G).

IX DEFINITIONS AND METHODS OF ANALYSIS (Continued)

G Total Sulfites; by Monier-Williams Method. (Continued)

This delivery tube (E) extends to bottom of receiver. One Peligot tube has been found to be sufficient to catch traces of sulfurous acid swept through flask (F). Use rubber stoppers throughout. Receiver (F) contains 15 ml of pure neutral 3% hydrogen peroxide (H_2O_2) while Peligot tube contains 5 ml of 3% hydrogen peroxide (H_2O_2) solution. Hydrogen peroxide usually contains free sulfuric acid. Start with 30% H_2O_2, dilute somewhat, and neutralize with $Ba(OH)_2$ solution, using bromphenol blue as indicator. After reagent has settled in cold, filter from the $BaSO_4$ and determine its concentration by titration with potassium permanganate ($KMnO_4$) and finally adjust to 3% concentration. The bromphenol blue indicator in the H_2O_2 remains unaffected for some time. After connecting the apparatus, introduce into the flask 300 ml of H_2O and 20 ml of HCl and boil a short time in a current of CO_2. Add 50 grams of double-diluted sirup from Brix determination directly to flask by means of the dropping funnel. Wash dropping funnel into flask. After introducing sugarcane sirup, boil mixture 1 hour in slow current of CO_2 stopping flow of water in condenser just before end of distillation. This causes condenser to become hot and drives over residual traces of SO_2 retained in condenser. When delivery tube above condenser becomes hot to touch remove stopper (J) immediately. Wash delivery tube and Peligot tube contents into flask (F) and titrate liquid at room temperature with 0.1N, NaOH, using bromphenol blue as indicator. The NaOH must be standardized with bromphenol blue. Bromphenol blue is unaffected by CO_2 and also gives distinct color change in cold H_2O_2.

1 Calculations.

1 ml of 0.1N NaOH = 3.2 milligrams of SO_2.
2.5 ml of 0.1N NaOH required for titration = 8.0 milligrams SO_2.
50 grams double-diluted sirup = 25 grams original sirup taken for analysis.
Brix 74° = 74 grams Brix solids in original sample.
8.0 mg SO_2 per 18.5 grams Brix solids.
0.432 mg per 1 gram Brix solids.
432 mg per 1,000 grams Brix solids.
432 parts per million in sample.

IX DEFINITIONS AND METHODS OF ANALYSIS (Continued)

H Total Sulfites; by Titration.

The approximate percent of SO_2 in the sample can be determined by titration using standardized iodine and thiosulfate solutions.

Add 50 grams of double diluted sirup from the Brix determination to a 500 ml distillation flask. Add about 300 ml of distilled water and 5 ml of 20 percent phosphoric acid solution. Connect the distillation flask to a glass condenser and allow the outlet of the condenser to dip below the surface of 50 ml of N/20 iodine solution in a 500 ml Ehrlenmeyer flask. Add about 1 gram of sodium bicarbonate of the distillation flask and quickly insert the rubber stopper connecting flask to condenser.

Distill over about 200 cc into the Ehrlenmeyer flask containing the iodine solution. If all of the iodine in the receiving flask is discharged before the distillation is complete more N/20 iodine solution may be added.

When distillation is completed add a few drops of starch indicator to the distillate and titrate the excess iodine with N/20 sodium thiosulfate solution until the blue color just disappears, leaving a water white solution.

1 Calculations.

1 ml N/20 iodine solution = 0.0016 grams or 1.6 mg of SO_2.
3.5 ml N/20 thiosulfate solution required for titration = 5.6 mg SO_2.
50 grams double diluted sirup = 25 grams original sirup taken for analysis.
Brix 74° - 74 grams Brix solids in original sirup.
25 grams sirup x 74° Brix = 18.5 grams Brix solids in sample.
5.6 mg SO_2 per 18.5 grams Brix solids.
0.302 mg per 1 gram Brix solids.
302 mg per 1000 grams Brix solids.
302 parts per million SO_2 in sample.

IX DEFINITIONS AND METHODS OF ANALYSIS (Continued)

I Foreign Material.

1 Examination for foreign material.

The following methods may be used in examining sugarcane sirup for foreign material:

a Method No. 1.

Mix the sample thoroughly and dissolve 200 grams in 200 ml of hot water acidulated with 5 ml of nitric acid (HNO_3). Filter at once through a cm rapid filter in suction funnel. Wash with a minimum quantity of hot water and examine microscopically.

b Method No. 2.

Dissolve 200 grams of sugarcane sirup in 500 ml of hot water. Filter at once through a United States Standard No. 120 woven wire sieve. Wash with a minimum quantity of hot water and examine microscopically.

2 Microanalysis.

Microanalysis should be made for worm and insect fragments in accordance with methods outlined in the AOAC, Eighth Edition, 1955.

REFERENCES: "Official Methods of Analysis of the Association of Official Agricultural Chemists," 8th Edition, 1955.

"Cane Sugar Handbook," 8th Edition, 1944, by Spencer-Meade.

Table No. 1

Refractive Indices of Sucrose Solutions at 20° C.

(International Scale - 1936)

Sucrose percent by weight	Refractive index at 20° C.	Sucrose percent by weight	Refractive index at 20° C.	Sucrose percent by weight	Refractive index at 20° C.	Sucrose percent by weight	Refractive index at 20° C.
%		%		%		%	
0.0	1.33299	3.0	1.33733	6.0	1.34176	9.0	1.34629
.1	1.33313	.1	1.33748	.1	1.34191	.1	1.34644
.2	1.33328	.2	1.33762	.2	1.33206	.2	1.34660
.3	1.33342	.3	1.33777	.3	1.34221	.3	1.34675
.4	1.33357	.4	1.33792	.4	1.34236	.4	1.34691
.5	1.33371	.5	1.33807	.5	1.34251	.5	1.34706
.6	1.33385	.6	1.33821	.6	1.34266	.6	1.34721
.7	1.33400	.7	1.33836	.7	1.34281	.7	1.34737
.8	1.33414	.8	1.33851	.8	1.34296	.8	1.34752
.9	1.33429	.9	1.33865	.9	1.34311	.9	1.34768
1.0	1.33443	4.0	1.33880	7.0	1.34326	10.0	1.34783
.1	1.33457	.1	1.33895	.1	1.34341	.1	1.34798
.2	1.33472	.2	1.33909	.2	1.34356	.2	1.34814
.3	1.33487	.3	1.33924	.3	1.34371	.3	1.34829
.4	1.33501	.4	1.33939	.4	1.34386	.4	1.34845
.5	1.33515	.5	1.33953	.5	1.34401	.5	1.34860
.6	1.33530	.6	1.33968	.6	1.34417	.6	1.34875
.7	1.33545	.7	1.33983	.7	1.34432	.7	1.34891
.8	1.33559	.8	1.33998	.8	1.34447	.8	1.34906
.9	1.33573	.9	1.34012	.9	1.34462	.9	1.34922
2.0	1.33588	5.0	1.34027	8.0	1.34477	11.0	1.34937
.1	1.33603	.1	1.34042	.1	1.34492	.1	1.34953
.2	1.33617	.2	1.34057	.2	1.34507	.2	1.34968
.3	1.33631	.3	1.34072	.3	1.34523	.3	1.34984
.4	1.33646	.4	1.34087	.4	1.34538	.4	1.34999
.5	1.33661	.5	1.34101	.5	1.34553	.5	1.35015
.6	1.33675	.6	1.34116	.6	1.34568	.6	1.35031
.7	1.33689	.7	1.34131	.7	1.34583	.7	1.35046
.8	1.33704	.8	1.34146	.8	1.34599	.8	1.35062
.9	1.33719	.9	1.34161	.9	1.34614	.9	1.35077

Table No. 1 (Continued)

Refractive Indices of Sucrose Solutions at 20° C.

Sucrose percent by weight %	Refractive index at 20° C.	Sucrose percent by weight %	Refractive index at 20° C.	Sucrose percent by weight %	Refractive index at 20° C.	Sucrose percent by weight %	Refractive index at 20° C.
12.0	1.35093	15.0	1.35567	18.0	1.36053	21.0	1.26551
.1	1.35109	.1	1.35583	.1	1.36069	.1	1.36568
.2	1.35124	.2	1.35599	.2	1.36086	.2	1.36585
.3	1.35140	.3	1.35615	.3	1.36103	.3	1.36601
.4	1.35156	.4	1.35631	.4	1.36119	.4	1.36618
.5	1.35171	.5	1.35647	.5	1.36135	.5	1.36635
.6	1.35187	.6	1.35664	.6	1.36152	.6	1.36652
.7	1.35203	.7	1.35680	.7	1.36169	.7	1.36669
.8	1.35219	.8	1.35696	.8	1.36185	.8	1.36685
.9	1.35234	.9	1.35712	.9	1.36201	.9	1.36702
13.0	1.35250	16.0	1.35728	19.0	1.36218	22.0	1.36719
.1	1.35266	.1	1.35744	.1	1.36235	.1	1.36736
.2	1.35282	.2	1.35760	.2	1.36251	.2	1.36753
.3	1.35297	.3	1.35777	.3	1.36268	.3	1.36770
.4	1.35313	.4	1.35793	.4	1.36284	.4	1.36787
.5	1.35329	.5	1.35809	.5	1.36301	.5	1.36803
.6	1.35345	.6	1.35825	.6	1.36318	.6	1.36820
.7	1.35361	.7	1.35841	.7	1.36334	.7	1.36837
.8	1.35376	.8	1.35858	.8	1.36351	.8	1.36854
.9	1.35392	.9	1.35874	.9	1.36367	.9	1.36871
14.0	1.35408	17.0	1.35890	20.0	1.36384	23.0	1.36888
.1	1.35424	.1	1.35906	.1	1.36401	.1	1.36905
.2	1.35440	.2	1.35923	.2	1.36417	.2	1.36922
.3	1.35456	.3	1.35939	.3	1.36434	.3	1.39639
.4	1.35472	.4	1.35955	.4	1.36451	.4	1.36956
.5	1.35487	.5	1.35971	.5	1.36467	.5	1.36973
.6	1.35503	.6	1.35988	.6	1.36484	.6	1.36991
.7	1.35519	.7	1.36004	.7	1.36501	.7	1.37008
.8	1.35535	.8	1.36020	.8	1.36518	.8	1.37025
.9	1.35551	.9	1.36037	.9	1.36534	.9	1.37042

Table No. 1 (Continued)

Refractive Indices of Sucrose Solutions at 20° C.

Sucrose percent by weight %	Refractive index at 20° C.	Sucrose percent by weight %	Refractive index at 20° C.	Sucrose percent by weight %	Refractive index at 20° C.	Sucrose percent by weight %	Refractive index at 20° C.
24.0	1.37059	27.0	1.3758	30.0	1.3811	33.0	1.3865
.1	1.3708	.1	1.3760	.1	1.3813	.1	1.3867
.2	1.3709	.2	1.3761	.2	1.3815	.2	1.3869
.3	1.3711	.3	1.3763	.3	1.3816	.3	1.3870
.4	1.3713	.4	1.3765	.4	1.3818	.4	1.3872
.5	1.3715	.5	1.3767	.5	1.3820	.5	1.3874
.6	1.3716	.6	1.3768	.6	1.3822	.6	1.3876
.7	1.3718	.7	1.3770	.7	1.3824	.7	1.3878
.8	1.3720	.8	1.3772	.8	1.3825	.8	1.3879
.9	1.3721	.9	1.3773	.9	1.3827	.9	1.3881
25.0	1.3723	28.0	1.3775	31.0	1.3829	34.0	1.3883
.1	1.3725	.1	1.3777	.1	1.3831	.1	1.3885
.2	1.3726	.2	1.3779	.2	1.3833	.2	1.3887
.3	1.3728	.3	1.3780	.3	1.3834	.3	1.3889
.4	1.3730	.4	1.3782	.4	1.3836	.4	1.3891
.5	1.3731	.5	1.3784	.5	1.3838	.5	1.3893
.6	1.3733	.6	1.3786	.6	1.3840	.6	1.3894
.7	1.3735	.7	1.3788	.7	1.3842	.7	1.3896
.8	1.3737	.8	1.3789	.8	1.3843	.8	1.3898
.9	1.3738	.9	1.3791	.9	1.3845	.9	1.3900
26.0	1.3740	29.0	1.3793	32.0	1.3847	35.0	1.3902
.1	1.3742	.1	1.3795	.1	1.3849	.1	1.3904
.2	1.3744	.2	1.3797	.2	1.3851	.2	1.3906
.3	1.3745	.3	1.3798	.3	1.3852	.3	1.3907
.4	1.3747	.4	1.3800	.4	1.3854	.4	1.3909
.5	1.3749	.5	1.3802	.5	1.3856	.5	1.3911
.6	1.3751	.6	1.3804	.6	1.3858	.6	1.3913
.7	1.3753	.7	1.3806	.7	1.3860	.7	1.3915
.8	1.3754	.8	1.3807	.8	1.3861	.8	1.3916
.9	1.3756	.9	1.3809	.9	1.3863	.9	1.3918

Table No. 1 (Continued)

Refractive Indices of Sucrose Solutions at 20° C.

Sucrose percent by weight %	Refractive index at 20° C.	Sucrose percent by weight %	Refractive index at 20° C.	Sucrose percent by weight %	Refractive index at 20° C.	Sucrose percent by weight %	Refractive index at 20° C.
36.0	1.3920	39.0	1.3978	42.0	1.4036	45.0	1.4096
.1	1.3922	.1	1.3980	.1	1.4038	.1	1.4098
.2	1.3924	.2	1.3982	.2	1.4040	.2	1.4100
.3	1.3926	.3	1.3984	.3	1.4042	.3	1.4102
.4	1.3928	.4	1.3986	.4	1.4044	.4	1.4104
.5	1.3929	.5	1.3987	.5	1.4046	.5	1.4107
.6	1.3931	.6	1.3989	.6	1.4048	.6	1.4109
.7	1.3933	.7	1.3991	.7	1.4050	.7	1.4111
.8	1.3935	.8	1.3993	.8	1.4052	.8	1.4113
.9	1.3937	.9	1.3995	.9	1.4054	.9	1.4115
37.0	1.3939	40.0	1.3997	43.0	1.4056	46.0	1.4117
.1	1.3941	.1	1.3999	.1	1.4058	.1	1.4119
.2	1.3943	.2	1.4001	.2	1.4060	.2	1.4121
.3	1.3945	.3	1.4003	.3	1.4062	.3	1.4123
.4	1.3947	.4	1.4005	.4	1.4064	.4	1.4125
.5	1.3949	.5	1.4007	.5	1.4066	.5	1.4127
.6	1.3950	.6	1.4008	.6	1.4068	.6	1.4129
.7	1.3952	.7	1.4010	.7	1.4070	.7	1.4131
.8	1.3954	.8	1.4012	.8	1.4072	.8	1.4133
.9	1.3956	.9	1.4014	.9	1.4074	.9	1.4135
38.0	1.3958	41.0	1.4016	44.0	1.4076	47.0	1.4137
.1	1.3960	.1	1.4018	.1	1.4078	.1	1.4139
.2	1.3962	.2	1.4020	.2	1.4080	.2	1.4141
.3	1.3964	.3	1.4022	.3	1.4082	.3	1.4143
.4	1.3966	.4	1.4024	.4	1.4084	.4	1.4145
.5	1.3968	.5	1.4026	.5	1.4086	.5	1.4147
.6	1.3970	.6	1.4028	.6	1.4088	.6	1.4150
.7	1.3972	.7	1.4030	.7	1.4090	.7	1.4152
.8	1.3974	.8	1.4032	.8	1.4092	.8	1.4154
.9	1.3976	.9	1.4034	.9	1.4094	.9	1.4156

Table No. 1 (Continued)

Refractive Indices of Sucrose Solutions at 20° C.

Sucrose percent by weight %	Refractive index at 20° C.	Sucrose percent by weight %	Refractive index at 20° C.	Sucrose percent by weight %	Refractive index at 20° C.	Sucrose percent by weight %	Refractive index at 20° C.
48.0	1.4158	51.0	1.4221	54.0	1.4285	57.0	1.4351
.1	1.4160	.1	1.4223	.1	1.4287	.1	1.4353
.2	1.4162	.2	1.4225	.2	1.4289	.2	1.4355
.3	1.4164	.3	1.4227	.3	1.4292	.3	1.4358
.4	1.4166	.4	1.4229	.4	1.4294	.4	1.4360
.5	1.4169	.5	1.4231	.5	1.4296	.5	1.4362
.6	1.4171	.6	1.4234	.6	1.4298	.6	1.4364
.7	1.4173	.7	1.4236	.7	1.4300	.7	1.4366
.8	1.4175	.8	1.4238	.8	1.4303	.8	1.4369
.9	1.4177	.9	1.4240	.9	1.4305	.9	1.4371
49.0	1.4179	52.0	1.4242	55.0	1.4307	58.0	1.4373
.1	1.4181	.1	1.4244	.1	1.4309	.1	1.4375
.2	1.4183	.2	1.4246	.2	1.4311	.2	1.4378
.3	1.4185	.3	1.4249	.3	1.4313	.3	1.4380
.4	1.4187	.4	1.4251	.4	1.4316	.4	1.4382
.5	1.4189	.5	1.4253	.5	1.4318	.5	1.4385
.6	1.4192	.6	1.4255	.6	1.4320	.6	1.4387
.7	1.4194	.7	1.4257	.7	1.4322	.7	1.4389
.8	1.4196	.8	1.4260	.8	1.4325	.8	1.4391
.9	1.4198	.9	1.4262	.9	1.4327	.9	1.4394
50.0	1.4200	53.0	1.4264	56.0	1.4329	59.0	1.4396
.1	1.4202	.1	1.4266	.1	1.4331	.1	1.4398
.2	1.4204	.2	1.4268	.2	1.4333	.2	1.4400
.3	1.4206	.3	1.4270	.3	1.4336	.3	1.4403
.4	1.4208	.4	1.4272	.4	1.4338	.4	1.4405
.5	1.4211	.5	1.4275	.5	1.4340	.5	1.4407
.6	1.4213	.6	1.4277	.6	1.4342	.6	1.4409
.7	1.4215	.7	1.4279	.7	1.4344	.7	1.4411
.8	1.4217	.8	1.4281	.8	1.4347	.8	1.4414
.9	1.4219	.9	1.4283	.9	1.4349	.9	1.4416

Table No. 1 (Continued)

Refractive Indices of Sucrose Solutions at 20° C.

Sucrose percent by weight %	Refractive index at 20° C.	Sucrose percent by weight %	Refractive index at 20° C.	Sucrose percent by weight %	Refractive index at 20° C.	Sucrose percent by weight %	Refractive index at 20° C.
60.0	1.4418	63.0	1.4486	66.0	1.4555	69.0	1.4627
.1	1.4420	.1	1.4488	.1	1.4557	.1	1.4629
.2	1.4423	.2	1.4491	.2	1.4560	.2	1.4632
.3	1.4425	.3	1.4493	.3	1.4562	.3	1.4634
.4	1.4427	.4	1.4495	.4	1.4565	.4	1.4637
.5	1.4429	.5	1.4497	.5	1.4567	.5	1.4639
.6	1.4432	.6	1.4500	.6	1.4569	.6	1.4641
.7	1.4434	.7	1.4502	.7	1.4572	.7	1.4644
.8	1.4436	.8	1.4504	.8	1.4574	.8	1.4646
.9	1.4439	.9	1.4507	.9	1.4577	.9	1.4649
61.0	1.4441	64.0	1.4509	67.0	1.4579	70.0	1.4651
.1	1.4443	.1	1.4511	.1	1.4581	.1	1.4653
.2	1.4446	.2	1.4514	.2	1.4584	.2	1.4656
.3	1.4448	.3	1.4516	.3	1.4586	.3	1.4658
.4	1.4450	.4	1.4518	.4	1.4589	.4	1.4661
.5	1.4453	.5	1.4521	.5	1.4591	.5	1.4663
.6	1.4455	.6	1.4523	.6	1.4593	.6	1.4666
.7	1.4457	.7	1.4525	.7	1.4596	.7	1.4668
.8	1.4459	.8	1.4527	.8	1.4598	.8	1.4671
.9	1.4462	.9	1.4530	.9	1.4601	.9	1.4673
62.0	1.4464	65.0	1.4532	68.0	1.4603	71.0	1.4676
.1	1.4466	.1	1.4534	.1	1.4605	.1	1.4678
.2	1.4468	.2	1.4537	.2	1.4608	.2	1.4681
.3	1.4471	.3	1.4539	.3	1.4610	.3	1.4683
.4	1.4473	.4	1.4541	.4	1.4613	.4	1.4685
.5	1.4475	.5	1.4544	.5	1.4615	.5	1.4688
.6	1.4477	.6	1.4546	.6	1.4617	.6	1.4690
.7	1.4479	.7	1.4548	.7	1.4620	.7	1.4693
.8	1.4482	.8	1.4550	.8	1.4622	.8	1.4695
.9	1.4484	.9	1.4553	.9	1.4625	.9	1.4698

Table No. 1 (Continued)

Refractive Indices of Sucrose Solutions at 20° C.

Sucrose percent by weight %	Refractive index at 20° C.	Sucrose percent by weight %	Refractive index at 20° C.	Sucrose percent by weight %	Refractive index at 20° C.	Sucrose percent by weight %	Refractive index at 20° C.
72.0	1.4700	75.3	1.4782	78.6	1.4865	81.9	1.4951
.1	1.4703	.4	1.4784	.7	1.4868		
.2	1.4705	.5	1.4787	.8	1.4871	82.0	1.4954
.3	1.4708	.6	1.4789	.9	1.4873	.1	1.4956
.4	1.4710	.7	1.4792			.2	1.4959
.5	1.4713	.8	1.4794	79.0	1.4876	.3	1.4962
.6	1.4715	.9	1.4797	.1	1.4878	.4	1.4964
.7	1.4717			.2	1.4881	.5	1.4967
.8	1.4720	76.0	1.4799	.3	1.4883	.6	1.4970
.9	1.4722	.1	1.4802	.4	1.4886	.7	1.4972
		.2	1.4804	.5	1.4888	.8	1.4975
73.0	1.4725	.3	1.4807	.6	1.4891	.9	1.4978
.1	1.4727	.4	1.4810	.7	1.4893		
.2	1.4730	.5	1.4812	.8	1.4896	83.0	1.4980
.3	1.4732	.6	1.4815	.9	1.4898	.1	1.4983
.4	1.4735	.7	1.4817			.2	1.4985
.5	1.4737	.8	1.4820	80.0	1.4901	.3	1.4988
.6	1.4740	.9	1.4822	.1	1.4904	.4	1.4991
.7	1.4742			.2	1.4906	.5	1.4993
.8	1.4744	77.0	1.4825	.3	1.4909	.6	1.4996
.9	1.4747	.1	1.4827	.4	1.4912	.7	1.4999
		.2	1.4830	.5	1.4914	.8	1.5001
74.0	1.4749	.3	1.4832	.6	1.4917	.9	1.5004
.1	1.4752	.4	1.4835	.7	1.4919		
.2	1.4754	.5	1.4838	.8	1.4922	84.0	1.5007
.3	1.4757	.6	1.4840	.9	1.4925	.1	1.5009
.4	1.4759	.7	1.4843			.2	1.5012
.5	1.4762	.8	1.4845	81.0	1.4927	.3	1.5015
.6	1.4764	.9	1.4848	.1	1.4930	.4	1.5017
.7	1.4767			.2	1.4933	.5	1.5020
.8	1.4769	78.0	1.4850	.3	1.4935	.6	1.5022
.9	1.4772	.1	1.4853	.4	1.4938	.7	1.5025
		.2	1.4855	.5	1.4941	.8	1.5028
75.0	1.4774	.3	1.4858	.6	1.4943	.9	1.5030
.1	1.4777	.4	1.4860	.7	1.4946		
.2	1.4779	.5	1.4863	.8	1.4949	85.0	1.5033

Table No. 2

Correction Table for Determining the Percentage of Sucrose by Means of the Refractometer when the Readings are Made at Temperatures Other than 20° C.

(International Temperature Correction Table - 1936)

Tem-pera-ture	Percentage of Sucrose														
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70
	Subtract from the percentage of sucrose														
°C.															
10	0.50	0.54	0.58	0.61	0.64	0.66	0.68	0.70	0.72	0.73	0.74	0.75	0.76	0.78	0.79
11	.46	.49	.53	.55	.58	.60	.62	.64	.65	.66	.67	.68	.69	.70	.71
12	.42	.45	.48	.50	.52	.54	.56	.57	.58	.59	.60	.61	.61	.63	.63
13	.37	.40	.42	.44	.46	.48	.49	.50	.51	.52	.53	.54	.54	.55	.55
14	.33	.35	.37	.39	.40	.41	.42	.43	.44	.45	.45	.46	.46	.47	.48
15	.27	.29	.31	.33	.34	.34	.35	.36	.37	.37	.38	.39	.39	.40	.40
16	.22	.24	.25	.26	.27	.28	.28	.29	.30	.30	.30	.31	.31	.32	.32
17	.17	.18	.19	.20	.21	.21	.21	.22	.22	.23	.23	.23	.23	.24	.24
18	.12	.13	.13	.14	.14	.14	.14	.15	.15	.15	.15	.16	.16	.16	.16
19	.06	.06	.06	.07	.07	.07	.07	.08	.08	.08	.08	.08	.08	.08	.08
	Add to the percentage of sucrose														
21	0.06	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
22	.13	.13	.14	.14	.15	.15	.15	.15	.15	.16	.16	.16	.16	.16	.16
23	.19	.20	.21	.22	.22	.23	.23	.23	.23	.24	.24	.24	.24	.24	.24
24	.26	.27	.28	.29	.30	.30	.31	.31	.31	.31	.31	.32	.32	.32	.32
25	.33	.35	.36	.37	.38	.38	.39	.40	.40	.40	.40	.40	.40	.40	.40
26	.40	.42	.43	.44	.45	.46	.47	.48	.48	.48	.48	.48	.48	.48	.48
27	.48	.50	.52	.53	.54	.55	.55	.56	.56	.56	.56	.56	.56	.56	.56
28	.56	.57	.60	.61	.62	.63	.63	.64	.64	.64	.64	.64	.64	.64	.64
29	.64	.66	.68	.69	.71	.72	.72	.73	.73	.73	.73	.73	.73	.73	.73
30	.72	.74	.77	.78	.79	.80	.80	.81	.81	.81	.81	.81	.81	.81	.81

Table No. 3

Temperature Corrections to Readings of Saccharometers (Brix Spindle)
(Standard at 20° C.)

Temperature in degrees centigrade	Observed percentage of sugar													
	0	5	10	15	20	25	30	35	40	45	50	55	60	70
	Subtract—													
0	0.30	0.49	0.65	0.77	0.89	0.99	1.08	1.16	1.24	1.31	1.37	1.41	1.44	1.49
5	0.36	0.47	0.56	0.65	0.73	0.80	0.86	0.91	0.97	1.01	1.05	1.08	1.10	1.14
10	0.32	0.38	0.43	0.48	0.52	0.57	0.60	0.64	0.67	0.70	0.72	0.74	0.75	0.77
11	0.31	0.35	0.40	0.44	0.48	0.51	0.55	0.58	0.60	0.63	0.65	0.66	0.68	0.70
12	0.29	0.32	0.36	0.40	0.43	0.46	0.50	0.52	0.54	0.56	0.58	0.59	0.60	0.62
13	0.26	0.29	0.32	0.35	0.38	0.41	0.44	0.46	0.48	0.49	0.51	0.52	0.53	0.55
14	0.24	0.26	0.29	0.31	0.34	0.36	0.38	0.40	0.41	0.42	0.44	0.45	0.46	0.47
15	0.20	0.22	0.24	0.26	0.28	0.30	0.32	0.33	0.34	0.36	0.36	0.37	0.38	0.39
16	0.17	0.18	0.20	0.22	0.23	0.25	0.26	0.27	0.28	0.28	0.29	0.30	0.31	0.32
17	0.13	0.14	0.15	0.16	0.18	0.19	0.20	0.20	0.21	0.21	0.22	0.23	0.23	0.24
18	0.09	0.10	0.10	0.11	0.12	0.13	0.13	0.14	0.14	0.14	0.15	0.15	0.15	0.16
19	0.05	0.05	0.05	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08
17.5	0.11	0.12	0.12	0.14	0.15	0.16	0.16	0.17	0.17	0.18	0.18	0.19	0.19	0.20
15.56 (60° F.)	0.18	0.20	0.22	0.24	0.26	0.28	0.29	0.30	0.30	0.32	0.33	0.33	0.34	0.34
	Add—													
21	0.04	0.05	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.09
22	0.10	0.10	0.11	0.12	0.12	0.13	0.14	0.14	0.15	0.15	0.16	0.16	0.16	0.16
23	0.16	0.16	0.17	0.17	0.19	0.20	0.21	0.21	0.22	0.23	0.24	0.24	0.24	0.24
24	0.21	0.22	0.23	0.24	0.26	0.27	0.28	0.29	0.30	0.31	0.32	0.32	0.32	0.32
25	0.27	0.28	0.30	0.31	0.32	0.34	0.35	0.36	0.38	0.38	0.39	0.39	0.40	0.39
26	0.33	0.34	0.36	0.37	0.40	0.40	0.42	0.44	0.46	0.47	0.47	0.48	0.48	0.48
27	0.40	0.41	0.42	0.44	0.46	0.48	0.50	0.52	0.54	0.54	0.55	0.56	0.56	0.56
28	0.46	0.47	0.49	0.51	0.54	0.56	0.58	0.60	0.61	0.62	0.63	0.64	0.64	0.64
29	0.54	0.55	0.56	0.59	0.61	0.63	0.66	0.68	0.70	0.70	0.71	0.72	0.72	0.72
30	0.61	0.62	0.63	0.66	0.68	0.71	0.73	0.76	0.78	0.78	0.79	0.80	0.80	0.81
35	0.99	1.01	1.02	1.06	1.10	1.13	1.16	1.18	1.20	1.21	1.22	1.22	1.23	1.22
40	1.42	1.45	1.47	1.51	1.54	1.57	1.60	1.62	1.64	1.65	1.65	1.65	1.66	1.65
45	1.91	1.94	1.96	2.00	2.03	2.05	2.07	2.09	2.10	2.10	2.10	2.10	2.10	2.08
50	2.46	2.48	2.50	2.53	2.56	2.57	2.58	2.59	2.59	2.58	2.58	2.57	2.56	2.52
55	3.05	3.07	3.09	3.12	3.12	3.12	3.12	3.11	3.10	3.08	3.07	3.05	3.03	2.97
60	3.69	3.72	3.73	3.73	3.72	3.70	3.67	3.65	3.62	3.60	3.57	3.54	3.50	3.43
27.5	0.43	0.44	0.46	0.48	0.50	0.52	0.54	0.56	0.58	0.58	0.59	0.60	0.60	0.60

Table No. 4

Factors for 10 Ml Soxhlet Solution to be Used in Connection with Lane-Eynon General Volumetric Method

Titer	Invert Sugar: No Sucrose	1 Gram Sucrose: Per 100 Ml Invert Sugar	5 Grams Sucrose: Per 100 Ml Invert Sugar	10 Grams Sucrose: Per 100 Ml Invert Sugar	Dextrose
15	50.5	49.9	47.6	46.1	49.1
16	50.6	50.0	47.6	46.1	49.2
17	50.7	50.1	47.6	46.1	49.3
18	50.8	50.1	47.6	46.1	49.3
19	50.8	50.2	47.6	46.1	49.4
20	50.9	50.2	47.6	46.1	49.5
21	51.0	50.2	47.6	46.1	49.5
22	51.0	50.3	47.6	46.1	49.6
23	51.1	50.3	47.6	46.1	49.7
24	51.2	50.3	47.6	46.1	49.8
25	51.2	50.4	47.6	46.0	49.8
26	51.3	50.4	47.6	46.0	49.9
27	51.4	50.4	47.6	46.0	49.9
28	51.4	50.5	47.7	46.0	50.0
29	51.5	50.5	47.7	46.0	50.0
30	51.5	50.5	47.7	46.0	50.1
31	51.6	50.6	47.7	45.9	50.2
32	51.6	50.6	47.7	45.9	50.2
33	51.7	50.6	47.7	45.9	50.3
34	51.7	50.6	47.7	45.8	50.3
35	51.8	50.7	47.7	45.8	50.4
36	51.8	50.7	47.7	45.8	50.4
37	51.9	50.7	47.7	45.7	50.5
38	51.9	50.7	47.7	45.7	50.5
39	52.0	50.8	47.7	45.7	50.6
40	52.0	50.8	47.7	45.6	50.6
41	52.1	50.8	47.7	45.6	50.7
42	52.1	50.8	47.7	45.6	50.7
43	52.2	50.8	47.7	45.5	50.8
44	52.2	50.9	47.7	45.5	50.8
45	52.3	50.9	47.7	45.4	50.9
46	52.3	50.9	47.7	45.4	50.9
47	52.4	50.9	47.7	45.3	51.0
48	52.4	50.9	47.7	45.3	51.0
49	52.5	51.0	47.7	45.2	51.0
50	52.5	51.0	47.7	45.2	51.1

Table No. 5

Factors for 25 Ml Soxhlet Solution to be Used in
Connection with Lane-Eynon General Volumetric Method

Titer	Invert Sugar No Sucrose	1 Gram Sucrose Per 100 Ml Invert Sugar	Dextrose	Levulose
15	123.6	122.6	120.2	127.4
16	123.6	122.7	120.2	127.4
17	123.6	122.7	120.2	127.5
18	123.7	122.7	120.2	127.5
19	123.7	122.8	120.3	127.6
20	123.8	122.8	120.3	127.6
21	123.8	122.8	120.3	127.7
22	123.9	122.9	120.4	127.7
23	123.9	122.9	120.4	127.8
24	124.0	122.9	120.5	127.8
25	124.0	123.0	120.5	127.9
26	124.1	123.0	120.6	127.9
27	124.1	123.0	120.6	128.0
28	124.2	123.1	120.7	128.0
29	124.2	123.1	120.7	128.1
30	124.3	123.1	120.8	128.1
31	124.3	123.2	120.8	128.1
32	124.4	123.2	120.8	128.2
33	124.4	123.2	120.9	128.2
34	124.5	123.3	120.9	128.3
35	124.5	123.3	121.0	128.3
36	124.6	123.3	121.0	128.4
37	124.6	123.4	121.1	128.4
38	124.7	123.4	121.2	128.5
39	124.7	123.4	121.2	128.5
40	124.8	123.4	121.2	128.6
41	124.8	123.5	121.3	128.6
42	124.9	123.5	121.4	128.6
43	124.9	123.5	121.4	128.7
44	125.0	123.6	121.5	128.7
45	125.0	123.6	121.5	128.8
46	125.1	123.6	121.6	128.8
47	125.1	123.7	121.6	128.9
48	125.2	123.7	121.7	128.9
49	125.2	123.7	121.7	129.0
50	125.3	123.8	121.8	129.0

Table No. 6

Jackson-Gillis Clerget Method IV*

Column No. 1 is the algebraic sum of P - P' corrected to normality. Column No. 2 is the Clerget Divisor corresponding to that value of P - P'. Apply temperature correction for exact temperature at which the invert polarization was read. Corrected Clerget Divisor divided into 100 (P - P') = Clerget Sucrose.

No. 1	No. 2	No. 1	No. 2	No. 1	No. 2	No. 1	No. 2
5	131.78	40	132.01	77	132.26	117	132.52
7	131.80	45	132.04	80	132.28	120	132.54
10	131.82	50	132.08	83	132.29	122	132.56
12	131.83	55	132.11	85	132.31	125	132.58
15	131.85	60	132.15	87	132.33	127	132.59
17	131.87	63	132.16	90	132.35	130	132.61
20	131.89	65	132.18	95	132.38	132.63	132.63
22	131.90	67	132.19	100	132.41	133	132.63
25	131.92	70	132.21	105	132.44		
30	131.95	72	132.22	110	132.47		
35	131.98	75	132.24	115	132.51		

The above table is based on sucrose concentration instead of on solids concentration, which has been shown to be the correct method.

*Bur. Standards Scientific Papers 375

Subtractive Temperature Corrections

°C.	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
20	0.00	0.05	0.11	0.16	0.21	0.27	0.32	0.37	0.42	0.48
21	0.53	0.58	0.64	0.69	0.74	0.80	0.85	0.90	0.95	1.01
22	1.06	1.11	1.17	1.22	1.27	1.33	1.38	1.43	1.48	1.54
23	1.59	1.64	1.70	1.75	1.80	1.86	1.91	1.96	2.01	2.07
24	2.12	2.17	2.23	2.28	2.33	2.39	2.44	2.49	2.54	2.60
25	2.65	2.70	2.76	2.81	2.86	2.92	2.97	3.02	3.07	3.13
26	3.18	3.23	3.29	3.34	3.39	3.44	3.50	3.55	3.60	3.66
27	3.71	3.76	3.82	3.87	3.92	3.98	4.03	4.08	4.13	4.19
28	4.24	4.29	4.35	4.40	4.45	4.51	4.56	4.61	4.66	4.72
29	4.77	4.82	4.88	4.93	4.98	5.04	5.09	5.14	5.19	5.25
30	5.30	5.35	5.41	5.46	5.51	5.57	5.62	5.67	5.72	5.78
31	5.83	5.88	5.94	5.99	6.04	6.10	6.15	6.20	6.25	6.31
32	6.36	6.41	6.47	6.52	6.57	6.63	6.68	6.73	6.78	6.84
33	6.89	6.94	7.00	7.05	7.10	7.16	7.21	7.26	7.31	7.37
34	7.42	7.47	7.53	7.58	7.63	7.69	7.74	7.79	7.84	7.90
35	7.95	8.00	8.06	8.11	8.16	8.22	8.27	8.32	8.37	8.43

Table No. 7

Conversion of Ounces Avoirdupois
to Fluid Ounces of Sugarcane Sirup

Fluid Ounces

Net Weight: Oz. Av. No. 2 Can	74° Brix	75° Brix	76° Brix	77° Brix	78° Brix	79° Brix	80° Brix
22-1/2	15.73	15.66	15.59	15.51	15.44	15.37	15.30
22-3/4	15.91	15.83	15.76	15.69	15.61	15.54	15.47
23	16.08	16.01	15.93	15.86	15.78	15.71	15.64
23-1/4	16.26	16.18	16.11	16.03	15.95	15.88	15.81
23-1/2	16.43	16.35	16.28	16.20	16.13	16.05	15.98
23-3/4	16.61	16.53	16.45	16.37	16.30	16.22	16.15
24	16.78	16.70	16.62	16.55	16.47	16.39	16.32
24-1/4	16.96	16.88	16.80	16.72	16.64	16.56	16.49
24-1/2	17.13	17.05	16.97	16.89	16.81	16.73	16.66
24-3/4	17.31	17.22	17.14	17.06	16.98	16.90	16.83
25	17.48	17.40	17.32	17.24	17.16	17.08	17.00
25-1/4	17.66	17.57	17.49	17.41	17.33	17.25	17.17
25-1/2	17.83	17.75	17.66	17.58	17.50	17.42	17.34
25-3/4	18.00	17.92	17.84	17.75	17.67	17.59	17.51
26	18.18	18.09	18.01	17.93	17.84	17.76	17.68
26-1/4	18.35	18.27	18.18	18.10	18.01	17.93	17.85
26-1/2	18.53	18.44	18.36	18.27	18.19	18.10	18.02
26-3/4	18.70	18.62	18.53	18.44	18.36	18.27	18.19
27	18.88	18.79	18.70	18.62	18.53	18.44	18.35
27-1/4	19.05	18.96	18.88	18.79	18.70	18.61	18.52
27-1/2	19.23	19.14	19.05	18.96	18.87	18.78	18.69
27-3/4	19.40	19.31	19.22	19.13	19.04	18.95	18.86
28	19.58	19.49	19.40	19.30	19.21	19.12	19.03
28-1/4	19.75	19.66	19.57	19.48	19.39	19.30	19.20
28-1/2	19.93	19.83	19.74	19.65	19.56	19.47	19.37

Table No. 7

Conversion of Ounces Avoirdupois
to Fluid Ounces of Sugarcane Sirup

Fluid Ounces

Net Weight: Oz. Av. No. 2-1/2 Can	74° Brix	75° Brix	76° Brix	77° Brix	78° Brix	79° Brix	80° Brix
34	23.77	23.66	23.55	23.44	23.33	23.22	23.11
34-1/4	23.95	23.84	23.72	23.61	23.50	23.39	23.28
34-1/2	24.12	24.01	23.90	23.79	23.68	23.56	23.45
34-3/4	24.30	24.18	24.07	23.96	23.85	23.73	23.62
35	24.47	24.36	24.24	24.13	24.02	23.91	23.79
35-1/4	24.65	24.53	24.42	24.30	24.19	24.08	23.96
35-1/2	24.82	24.71	24.59	24.48	24.36	24.25	24.13
35-3/4	25.00	24.88	24.76	24.65	24.53	24.42	24.30
36	25.17	25.05	24.94	24.82	24.70	24.59	24.47
36-1/4	25.35	25.23	25.11	24.99	24.88	24.76	24.64
36-1/2	25.52	25.40	25.28	25.17	25.05	24.93	24.81
36-3/4	25.70	25.57	25.46	25.34	25.22	25.10	24.98
37	25.87	25.75	25.63	25.51	25.39	25.27	25.15
37-1/4	26.05	25.92	25.80	25.68	25.56	25.44	25.32
37-1/2	26.22	26.10	25.98	25.85	25.73	25.61	25.49
37-3/4	26.40	26.27	26.15	26.03	25.91	25.78	25.66
38	26.57	26.45	26.32	26.20	26.08	25.95	25.83
38-1/4	26.75	26.62	26.50	26.37	26.25	26.13	26.00
38-1/2	26.92	26.79	26.67	26.54	26.42	26.30	26.17
38-3/4	27.09	26.97	26.84	26.72	26.59	26.47	26.34
39	27.27	27.14	27.02	26.89	26.76	26.64	26.51
39-1/4	27.44	27.32	27.19	27.06	26.93	26.81	26.68
39-1/2	27.62	27.49	27.36	27.23	27.11	26.98	26.85
39-3/4	27.79	27.66	27.53	27.41	27.28	27.15	27.02
40	27.97	27.84	27.71	27.58	27.45	27.32	27.19

Table No. 7

Conversion of Ounces Avoirdupois
to Fluid Ounces of Sugarcane Sirup

Fluid Ounces

Net Weight: Oz. Av.: No. 10 Can:	74° Brix	75° Brix	76° Brix	77° Brix	78° Brix	79° Brix	80° Brix
130	90.90	90.47	90.05	89.63	89.21	88.79	88.38
130-1/4	91.07	90.65	90.22	89.80	89.38	88.96	88.55
130-1/2	91.25	90.82	90.40	89.97	89.55	89.13	88.72
130-3/4	91.42	91.00	90.57	90.15	89.73	89.30	88.89
131	91.60	91.17	90.74	90.32	89.90	89.48	89.06
131-1/4	91.77	91.34	90.92	90.49	90.07	89.65	89.23
131-1/2	91.95	91.52	91.09	90.66	90.24	89.82	89.40
131-3/4	92.12	91.69	91.26	90.84	90.41	89.99	89.57
132	92.30	91.87	91.44	91.01	90.58	90.16	89.74
132-1/4	92.47	92.04	91.61	91.18	90.75	90.33	89.91
132-1/2	92.65	92.21	91.78	91.35	90.92	90.50	90.08
132-3/4	92.82	92.39	91.96	91.53	91.10	90.67	90.25
133	93.00	92.56	92.13	91.70	91.27	90.84	90.42
133-1/4	93.17	92.74	92.30	91.87	91.44	91.01	90.59
133-1/2	93.35	92.91	92.48	92.04	91.61	91.18	90.76
133-3/4	93.52	93.08	92.65	92.22	91.78	91.35	90.93
134	93.70	93.26	92.82	92.39	91.96	91.52	91.10
134-1/4	93.87	93.43	93.00	92.56	92.13	91.69	91.27
134-1/2	94.05	93.61	93.17	92.73	92.30	91.87	91.43
134-3/4	94.22	93.78	93.34	92.91	92.47	92.04	91.60
135	94.39	93.95	93.51	93.08	92.64	92.21	91.77
135-1/4	94.57	94.13	93.69	93.25	92.81	92.38	91.94
135-1/2	94.74	94.30	93.86	93.42	92.98	92.55	92.11
135-3/4	94.92	94.48	94.03	93.59	93.16	92.72	92.28
136	95.09	94.65	94.21	93.77	93.33	92.89	92.45
136-1/4	95.27	94.82	94.38	93.94	93.50	93.06	92.62
136-1/2	95.44	94.99	94.55	94.11	93.67	93.23	92.79

In constructing Table No. 7 the following specific gravities were used for sugarcane sirup corresponding to the different densities of sirup:

Degrees Brix	Specific gravity @ 20/20° C. 1/
74	1.37496
75	1.38141
76	1.38790
77	1.39442
78	1.40098
79	1.40758
80	1.41421

The following formula was used in the calculations:

$$\text{Fl. Oz.} = \frac{\text{Avoir. oz.} \times 0.9614}{\text{Sp. gr.}}$$

ACTION BY: All Employees Of The Branch

APPROVED BY: [signature]
Chief Of The Branch

FILE UNDER: SUGARCANE SIRUP

HANDBOOK CONTROL RECORD

REMOVE PAGES	DATED	INSERT PAGES	DATED	ATTACHMENTS OR REFERENCES