BULLETIN 105 SEPTEMBER 1942

SUGARCANE AND SORGHUM SIRUP FOR HOME USE

H. A. WOODLE
Extension Agronomist

C. V. PHAGAN
Extension Agricultural Engineer

CLEMSON AGRICULTURAL COLLEGE
Cooperating with
UNITED STATES DEPARTMENT OF AGRICULTURE
EXTENSION SERVICE
D. W. WATKINS, Director
Clemson, South Carolina

Cooperative Extension Work in Agriculture and Home Economics, The Clemson Agricultural College and The United States Department of Agriculture Cooperating. Distributed in Furtherance of the Acts of Congress of May 8 and June 30, 1914.

TABLE OF CONTENTS

SUGARCANE AND SORGHUM SIRUP FOR HOME USE

H. A. WOODLE
Extension Agronomist

C. V. PHAGAN
Extension Agricultural Engineer

FOREWORD

The war has had at least one good effect in many South Carolina farm homes; it has "Put the sirup pitcher back on the dinner table". The old-fashioned sirup pitcher had been stored away and almost forgotten, but now it is back in the place of honor; and we hope it is back to stay. Homemade sirups satisfy the body needs for "sweets" and, in addition, supply vital minerals not found in refined sugar.

Either sugarcane or sorghum sirup is a valuable addition to the family diet that can be produced inexpensively on South Carolina farms. In past years, practically every farmer took great pride in his sugarcane or sorghum "patch", and liked to brag about the quality of his homemade sirup. However, in recent years most farmers have failed to continue this practice, and with many farmers the growing and making of sirup has become a lost art. During the present war emergency, a balanced and nutritious diet is more important than ever before, and the farm production of sirup for home use is more important than ever before, and the farm production of sirup for home use is a proven means of increasing economically the family food supply.

South Carolina farmers are also increasing their production of homemade sirups for another reason. For a long time farmers in this state have proved that the most economical and practical method of boll weevil control is the 1-1-1 sweetened poison mixture. Many are now growing, making, and using their own sirup for this purpose. Unless conditions change materially, the practice will be even more economical and important during the next year.

SUGARCANE FOR SIRUP

Sugarcane requires a long, warm growing season, and in the United States is, with few exceptions, grown only in a limited area several hundred miles wide along the south Atlantic coast and the Gulf coast. Sugarcane should not be confused with one of the sweet sorghums, commonly called "Seeded Ribbon Cane". Only the cane propagated by stalk planting should be called sugarcane. In reality sugarcane is a tropical plant, being grown in the United States somewhat outside its natural climatic zone.

Figure 1.—Improved variety on the left, old variety on the right

Soils

Soil selection is very important in the production of sugarcane, since this crop is a heavy feeder which demands abundant plant food, humus, and moisture. Since most of the soils in the sugarcane belt are of a sandy nature, the farmer should select a site where the soil is well drained but where the silty clay composition retains moisture well. Neither light sandy soils nor heavy clay soils are adaptable. The texture of the soil should allow thorough cultivation and permit rapid and prolific root development.

The color and flavor of the sirup depend to a large degree upon the kind of soil on which the cane is grown. Sandy loam soils produce lighter colored and better flavored sirups, while

heavier bottom soils yield darker sirups with a less desirable flavor. In the low flat areas where natural drainage does not keep the ground water level three feet or more below the surface, it is essential that artificial drainage be provided.

Varieties

A disease-resistant variety of sugarcane is essential under present conditions. Many of the old varieties grown in this state were very susceptible to mosaic disease. Most farmers in South Carolina now plant Co. 290. The United States Department of Agriculture has tested numerous varieties to find those that are resistant or highly tolerant to mosaic, red rot, and smut. Co. 290 and C. P. 29/116 have been developed and introduced in recent years and have largely replaced older varieties such as P. O. J. 213, C. P. 807, and Cayana. Co. 290 is especially popular. The U. S. Department of Agriculture Laboratory at Cairo, Georgia, has recently distributed a new variety, C. P. 31/511, which seems to hold much promise. The new varieties withstand mosaic and red rot, and they also possess superior physical characteristics and yielding capacity, while producing high quality sirup.

Varieties of sugarcane are usually designated by letters or other abbreviations which indicate the origin of the seedling cane. The meaning of such designations for varieties as mentioned are as follows: C. P., Canal Point, Florida seedlings; Co., Coimbatore, India, seedlings; P. O. J., Proefstation Oost, Java, seedlings.

Fertilization

Commercial fertilizers in large amounts are used by practically all sugarcane growers. The amount and kind of fertilizer depends upon the soil type, the previous soil treatment, and the preceding crop. Many farmers use 1000 to 1500 pounds per acre of a complete fertilizer mixture such as a 4-12-4, while many other equally successful farmers use only 500 to 600 pounds of a complete fertilizer mixture per acre. Heavy applications of barnyard manure are profitable but should be applied on the preceding crop. The use of manure, especially horse manure, makes the sirup dark in color and imparts a salty flavor. It is profitable to apply some form of nitrogenous fertilizer as a side-dressing. In past years many farmers used 300 to 500 pounds of cottonseed meal per acre as a side-dressing applied in late spring. At the present time cottonseed meal is being replaced by other nitrogenous materials. Side-dressing with nitrogenous fertilizers in late summer has been almost discontinued, chiefly because such a practice is liable to exert a harmful effect upon the quality of the sirup.

The complete fertilizer is distributed in the furrow in which the cane is to be dropped, and it is then mixed with the soil by running a shovel plow or similar implement behind the distributor. Only part of the complete fertilizer is applied at planting time, the second application being made as a side-dressing about the middle of May.

The value of green manure crops for restoring or improving the fertility of the soil has been amply demonstrated, and such crops should be utilized whenever it is possible to do so without interfering too seriously with the crop rotation. Green manure crops improve both the light and the heavy soil types. The trash remaining after the cane is harvested is usually burned, but the practice is not recommended, since turning it under returns plant nutrients and organic matter to the soil, while improving the soil texture and the moisture-holding capacity. Burning the trash is not only valueless in reducing injury from insect pests but actually results in destruction of certain beneficial insects.

Planting

The soil for sugarcane is prepared in a similar manner as for other crops. The land should be broken early and all crop residue incorporated into the soil well in advance of planting. In the extreme southern section of the sugarcane belt, the cane is often planted in the fall, but practically all planting in this state is done in the early spring.

The rows are opened deep with a "middle buster" plow, being spaced four to six feet in width. The wider row width is used on the more fertile soils. The seed cane is stripped, cut in three-or four-foot lengths of sound stalks and dropped in a continuous line in the furrow. The cane is covered one to two inches deep. About 2500 stalks averaging four feet in length are needed to plant an acre in 4½ foot rows. When the seed stalks are damaged or diseased, a heavier rate is used in order to assure a good stand.

Cultivation

The culture of sugarcane is very similar to that of other crops. Early cultivation may be rather deep, but later cultivations must be shallow. Normally, at least two hoeings are necessary in order to clean out weeds and grass in the rows. Sugarcane is laid by when the crop shades the ground, which is usually the latter part of July.

Harvesting

Harvesting in the fall is ordinarily delayed as long as possible but must be early enough to avoid damage from frost.

Sugarcane could often be harvested during the latter part of October, but most small growers wait until the middle of November. Practically all sugarcane harvesting is done by hand. This consists of stripping off the leaves, removing the tops, and cutting off the stalks at the bottom. The lower part of the stalk is more mature and therefore contains more sugar, and the grower should save as much of it as possible by cutting at the level of the ground. The upper part of the stalk is least mature, and the topmost joints are of little or no value for the manufacture of sirup. Usually two or more of the topmost exposed joints should be discarded when the top is cut off.

All leaves should be removed before crushing, since the leaves decrease the amount of juice and often result in a cloudy, dark, and inferior sirup. The cane should be ground and made into sirup as soon as possible after cutting, preferably on the same day it is cut and stripped.

Well matured stalks should be saved for seed. The leaves and tops are not removed, and the stalks are windrowed or banked. The edges of the windrow or bank are covered with a turnplow and the remainder covered by hand with a shovel. The depth of soil covering varies from two to six inches, depending upon the locality.

SWEET SORGHUM FOR SIRUP

Sweet sorghums for sirup are grown over a much larger area than is sugarcane. "Sorgo" is the name now preferred by the United States Department of Agriculture for the varieties of sorghum that have abundant sweet juice, as distinguished from the grain-producing varieties. However, in South Carolina very few farmers have ever heard the name Sorgo, but every farmer understands what is meant by sweet sorghum and sorghum sirup.

Sorghum (or Sorgo) sirup of the best quality makes excellent table sirup, as it is light in color and has a mild and pleasant flavor. Many farm families prefer sorghum sirup to all other sirups. Most of the sirup has a very limited distribution, chiefly because there are very few commercial producers and because most of the sorghum sirup is used in the farm home. For many years practically every Piedmont and mountain farmer had a "sirup patch" which supplied his family with wholesome home-made sirup, but most farmers have failed to continue this practice. The present war conditions have changed the picture somewhat, and now more and more farmers are turning again to sorghum sirup as a means of saving many dollars formerly spent for other sweets for the family table.

Sweet sorghums (and some grain sorghums) are also used for silage, producing high yields of excellent silage, especially when mixed with a legume crop such as soybeans. In many sections of Piedmont South Carolina sweet sorghums are used as a hay crop in a sorghum and cowpea mixture. Sweet sorghums are grown successfully on many soil types and under many different climatic conditions. The crop is a heavy feeder, but stands drought better than most other crops.

The production of sorghum sirup is ordinarily considered a farm or a neighborhood enterprise. If a farmer has a sirup mill, he usually grinds the sorghum and manufactures the sirup for his neighbors who haul their crops to the mill. The farmer who owns and operates the mill charges a toll for his services, and he often has a small surplus of sirup for sale. The average farmer in South Carolina rarely grows more than one acre of sweet sorghum for sirup; however, this is usually sufficient for home use.

Soils

The choice of soil has a direct bearing on the quality of sirup, but there are many soil types that will produce an excellent quality of sorghum sirup. The best quality of sirup cannot be produced on poorly drained or heavy soil types. Experience has proved that it is best to select a fertile and well drained upland sandy loam, a soil that will produce a good crop of corn or wheat.

Plenty of organic matter is desirable and beneficial, but an excess of undecayed organic matter is detrimental. Strongly acid soils should be avoided. Since the average farmer plants only a "patch", the crop is easy to fit into the ordinary rotation, usually replacing corn. Sorghum is a soil-depleting crop, which should be followed with a winter cover crop, preferably a small grain and winter legume mixture.

Varieties

South Carolina experience indicates that the late-maturing varieties of sweet sorghum produce the best sirup. Amber, Orange, Honey, and Sugar Drip are generally recommended in this state; however, from a practical standpoint it is very hard, and sometimes impossible, for farmers to obtain seed of pure varieties. Most of the seed offered for sale are mixtures of two or more varieties.

One of the Amber varieties is desirable where early maturity must be considered, since these varieties mature in 75 or 100 days from planting. Sugar Drip is a medium late variety which requires 100 to 125 days to mature. The Honey variety is very late maturing, but is very popular because it produces very high yields of excellent quality sirup. Both Honey and Goose Neck are often misnamed "Texas Seeded Ribbon Cane". It is a good idea for any farmer to choose a variety of sweet sorghum that is known to produce quality sirup in his locality.

Fertilization

Fairly heavy applications of complete fertilizer mixtures are considered necessary in producing high yields of quality sorghum sirup. The amount and kind of fertilizer will vary according to the fertility of the soil and the previous crop and fertilizer treatment. Generally 200 to 500 pounds per acre of a 4-12-4 fertilizer should be used. The fertilizer is mixed with the soil by running a small "scooter" or shovel plow behind the distributor or it may be distributed by means of a distributor attachment on the planter which places the fertilizer so that it does not come in direct contact with the seed.

Sweet sorghum should be side-dressed with 100 to 200 pounds per acre of a nitrogenous fertilizer when the plants are about 40 days old. In former years many farmers used 200 to 400 pounds per acre of cottonseed meal as a side-dressing. While cottonseed meal is still considered a good fertilizer for sorghum, the meal is too expensive and too valuable as a feed to use as a fertilizer. Sorghum responds to applications of barnyard manure, but manure is not recommended for sweet sorghum to be used for making sirup. Barnyard manure should be applied on some other crop in the rotation.

Planting

The soil should be turned early enough to allow time for decay of crop residue. Thorough soil preparation will pay good dividends. In general, the land is prepared as for corn, with rows three to four feet wide. Unlike corn, sorghum is usually planted on a bed or ridge, but the bed should not be too high and should be dragged down with a plank drag before planting. A firm seedbed is essential.

The time of planting sweet sorghums for sirup varies in different localities. The ground should be thoroughly warm therefore, most farmers find it best to plant two or three weeks after corn-planting time. The use of a planter with a sorghum plate is recommended, since this will help insure a stand of plants four to six inches apart in the drill. Sorghum seed should not be planted as deep as corn seed. It is best to plant at a rate of eight to 10 pounds of seed per acre.

Cultivation

In general, sweet sorghum is cultivated in the same manner as corn. Cultivate shallow and often enough to keep down weeds and grass, keeping the dirt pushed toward the stalk and over the feed roots. A weeder or a spike-tooth harrow may be used advantageously to cross-harrow the field early in the season in order to kill the young grass and weeds. The number of cultivations that can be given economically will vary with the time of planting, the variety, the length of the growing season, and the climatic conditions. Three to six cultivations will usually be necessary in order to keep the weeds in check.

Harvesting

The time of harvesting sweet sorghum for sirup is important. If the sorghum is too green or too ripe, an inferior grade of sirup is very likely to result. Many farmers prefer to harvest in the "soft dough" stage, but somewhere between the soft and hard dough stage is probably better. After complete maturity the stalks become less juicy and produce a sirup of darker color and stronger flavor.

A single light frost does not ordinarily cause any serious injury to the growing crop. If a heavy frost occurs while the plants are still immature, or if there are repeated light frosts, the vitality of the plants will be so lowered that deterioration will follow. Frost damage is always noticed by the sirup maker, since the juice from frost-damaged sorghum gives off a putrid odor when heated.

Stalks are usually stripped of all leaves while still standing in the field, though they can be stripped after cutting. Some-

times the seedheads are cut off while the stalks are still standing, but it is much easier and more economical to cut off the heads after the stalks have been piled with the heads all in one direction. An inferior sirup of dark color is likely to result if the leaves and heads are not removed carefully. If harvested at the right stage of maturity, stalks should be cut close to the ground but high enough to avoid the rooted portion. It is always advisable to grind the stalks as soon as possible after cutting, preferably on the same day.

It is a good rule for the grower to save his own planting seed. Seed saved for planting should be given special care to insure purity and high viability. Only well matured heads selected from the field before harvesting should be retained, and these heads should be carefully cured until thoroughly dry. Seed that are not field-selected will vary considerably in quality because the crop is ordinarily harvested before all of the heads are completely ripe. Seeds saved for planting may be beaten out with a flail or an ordinary stick, or they may be raked off by drawing the heads across a row of spikes projecting close together from a plank or board. If the amount justifies, an ordinary grain thresher may be adjusted to thresh sorghum seed by removing part of the concave teeth and reducing the cylinder speed.

MAKING SUGARCANE AND SORGHUM SIRUP ON THE FARM

The quality of farm-made sorghum and sugarcane sirup is greatly influenced by the equipment and the process used in making it and by the skill of the sirup maker. Remodeling a sirup plant to improve the quality of sirup is not necessarily an expensive undertaking. Certain changes in equipment or methods may save time and labor and thus cut down the cost of making sirup.

The recommendations for making sirup as given below are primarily for small, farm-size plants. Information on the operation of larger plants may be had from some of the references at the end of this circular.

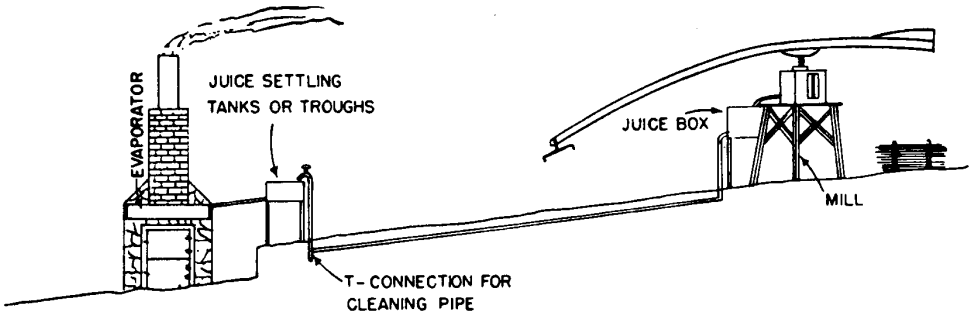

Figure 2.—Hillside layout

Hillside Layout

A great deal of labor can be saved around the sirup plant if the mill can be located on higher ground than the evaporator in order to obtain gravity flow of juice through a pipe. Three-fourths-inch to one-inch galvanized pipe should be used. A T-connection should be made in the low point of the line to permit easy cleaning. Figure 2 shows a typical hillside layout.

Mills for sirup plants may be operated by animal power or by motors. Figure 3 shows a typical three-roller vertical horse-power mill. Figure 4 shows a common type of three-roller power mill.

Care should be taken to have the mill level and rigid, which means well braced. Careful adjustment of mills is important in order to obtain good extraction. The recommended clearance space between the front roll and the large roll is approximately 3/8 of an inch. The recommended clearance between the last roll and the large roll is about 1/16 of an inch. This setting of the rolls permits the cane to feed regularly and yet give good extraction. Speeds of power mills should be regulated according to the recommendations of the manufacturer. Table 1 shows recommended equipment for small-scale sirup making.

Table I.—Recommended Equipment for Small-Scale Sirup Making on the Farm
(Courtesy U. S. D. A.)

Capacity of mill in tons of sugarcane per 12-hour day	Power	Length of evaporator	Size of kettle
	Horsepower	Feet	Gallons
3 to 5 (horse or mule operated)	1	7.5	60
6 to 8 (horse or mule operated)	2	10.5	100
9 to 11	6 to 8	12	

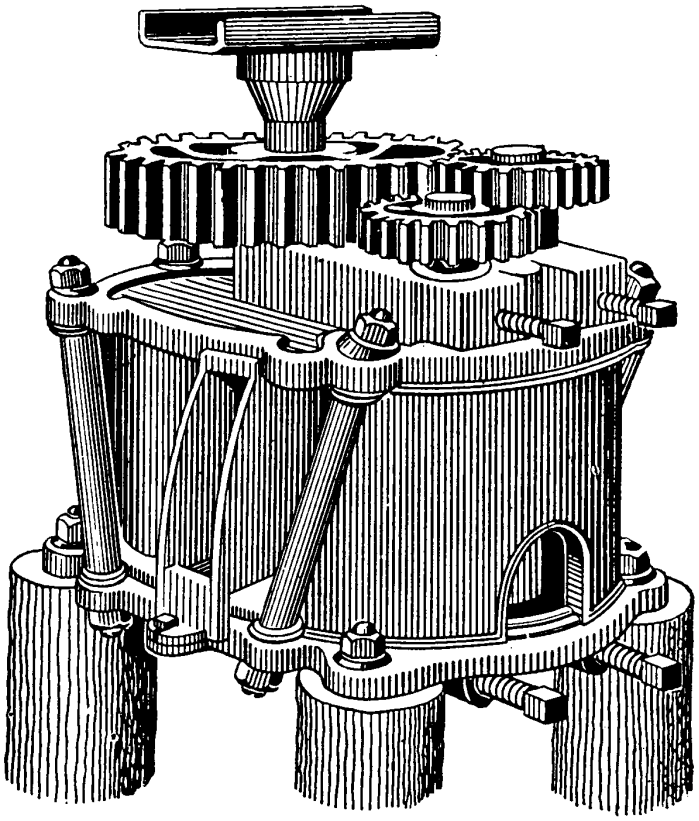

Figure 3.—Three-roller vertical horsepower mill
(From Farmers' Bulletin 1791, U. S. D. A.)

Straining and Settling of Juice

Care in removing as much as possible of the impurities of the cold juice by settling before it runs into the evaporator will be well repaid in improved quality of the sirup. The juice box or barrel at the mill need not be larger than 20 to 25 gallons capacity. The juice should be strained from the mill into this box through a screen or sack. After flowing through the pipe it should be strained again through copper or galvanized screen wire and several layers of cheese cloth.

Three juice-settling tanks at the evaporator provide the best arrangement for throughly settling the juice. Each tank should have a capacity of one to two hours; that is, a capacity sufficient

to take care of one to two hours' operation of the mill. This will allow one tank to be settling while another tank is being filled and the third tank is being used at the evaporator.

If it is not convenient to arrange three settling tanks, a trough six or eight feet long does a very good job of settling the juice. The outlet should be one or two inches above the bottom of the trough in order to prevent complete drainage of sediment

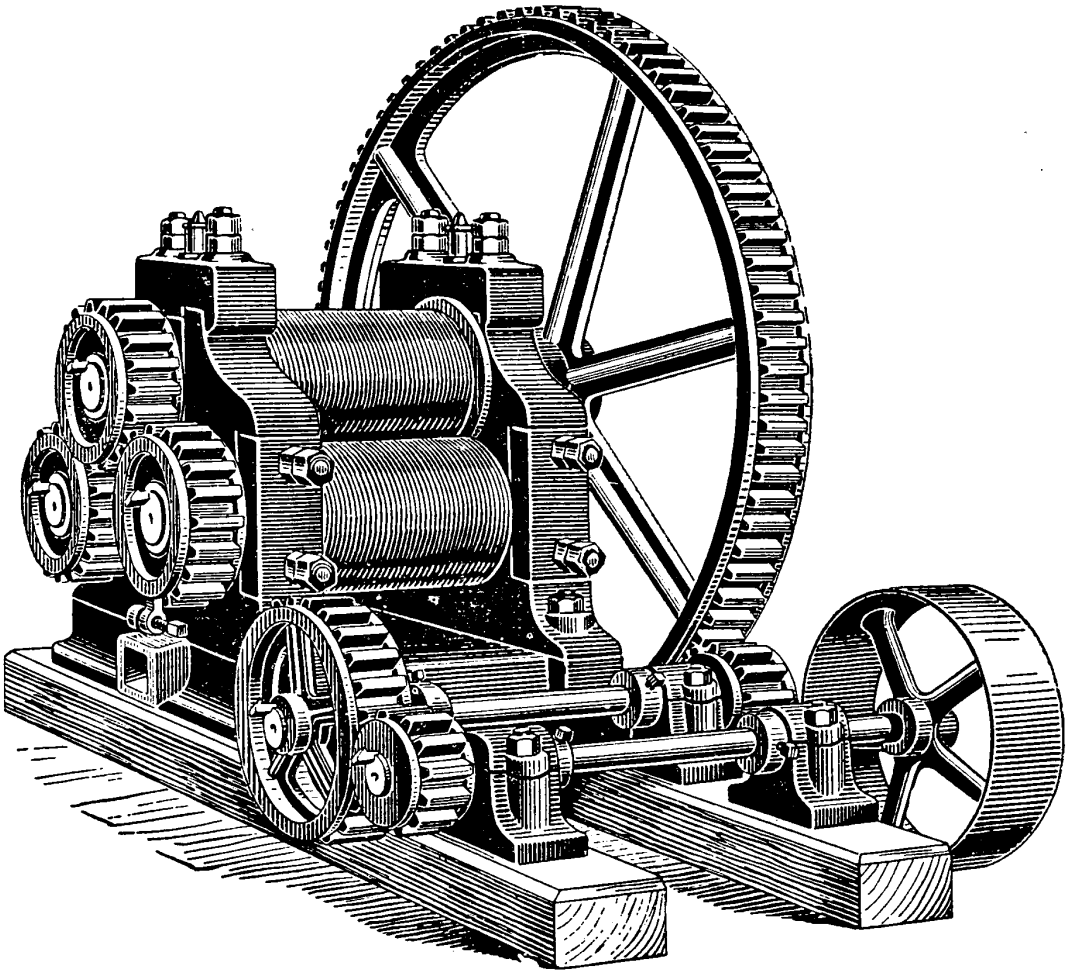

Figure 4.—Three-roller power mill.
(From Farmers' Bulletin 1791, U. S. D. A.)

and other foreign material. A second outlet should be made in the bottom of all juice-settling tanks to permit draining and washing and emptying.

The addition of chemicals to juice to aid in settling or in the removal of impurities is not recommended for small-scale sirup makers. Chemicals are sometimes used for removing impurities, but the practice often results in changing the flavor of the sirup.

Furnace for Evaporator

The successful operation of furnace-type evaporators depends to a great extent upon the design and construction of the fur-

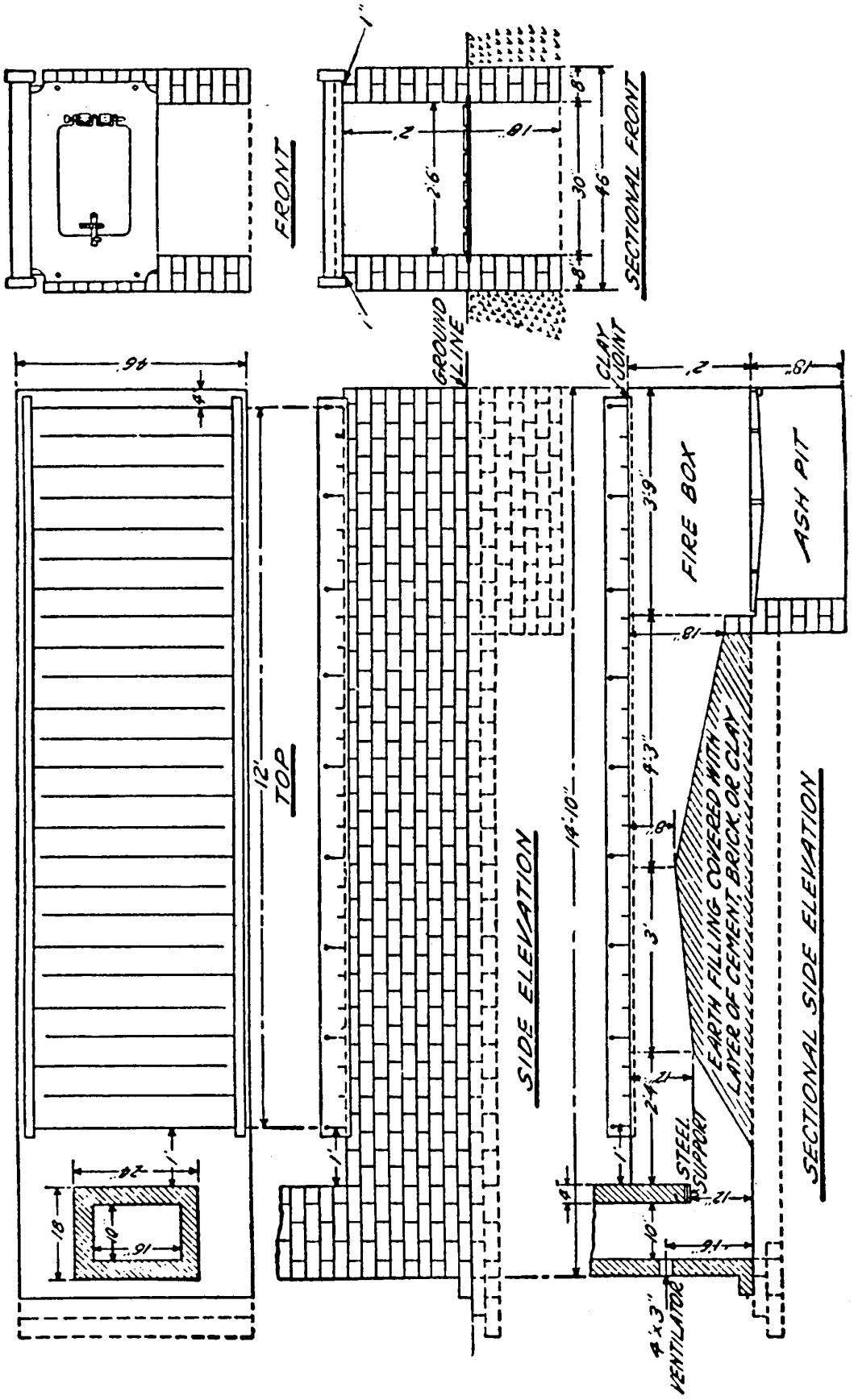

Figure 5.—For shorter furnaces the length of the fire box may be decreased to 3 feet and other longitudinal dimensions reduced in proportion (From Farmers' Bulletin 1791, U. S. D. A.

nace. The capacity of a plant equipped with a mill and an evaporator of the best type may be reduced as much as 50 percent by an improperly constructed furnace. Figure 5 shows dimensions for constructing a 12-foot continuous evaporator and furnace. For shorter furnaces the length of the fire box may be decreased to three feet and other longitudinal dimensions decreased in proportion. The dimensions for width, height, distances of grate below pan, and thickness of wall apply also to furnaces for evaporators of other lengths. The distribution of heat over the bottom of the pan is controlled by filling in the furnace between the end of the grates and the chimney. The high point of this fill should come within six or eight inches of the bottom of the pan and should be one to one and a half feet past the middle of the pan toward the chimney. From this high point the fill slopes down gradually to the last section where it drops off suddenly to the bottom of the stack, which should be on a level with the grate bars of the firebox.

The firebox of the furnace should be provided with a door of some sort. The furnace should be so located that the front end faces prevailing winds and the ash pit should be reasonably deep to permit reasonable access of air to the fire box from beneath. Some sirup makers keep the ash pit partly filled with water to prevent the excessive accumulation of heat under the cold juice section of the evaporator.

The back of the firebox should be built up about six inches higher than the level of the grates in order to prevent the filling in the furnace from sliding down into the firebox. The dirt filling, of course, should be covered with a layer of brick, cement, or hard clay.

The chimney of the furnace should be at least as high as the furnace is long. In some cases it might be necessary to increase the height to obtain better draft. A 3" x 4" damper in the chimney could be used to good advantage in the regulation of draft.

Evaporators

The proper setting of the evaporator on the furnace is important. It should be placed on the furnace level from side to side but should be one inch lower at the juice end than at the sirup end. To obtain the maximum amount of heat from the furnace, the metal bottom should project over the outside edge of the single brick line one inch on each side. This one inch of air space protects the wooden sides from the fire. The single line of bricks on which the furnace is placed should be flush with the inside surface of the furnace wall. The front of the evaporator should be within about six inches of the front of the furnace, and a space of one to two feet should be left between the front

of the chimney and the back end of the evaporator. A small crack is sometimes left next to the back end of the evaporator to admit air to the chimney end of the furnace. This prevents too close contact of the flame with the sirup end of the pan.

Continuous evaporators sometimes called "patented evaporators" are made of either galvanized iron or copper. Although copper evaporators cost nearly twice as much as galvanized evaporators, the extra expense is more than counterbalanced by the advantages gained. Copper lasts much longer than galvanized iron; it can be easily cleaned with acids without danger of rust, while galvanized iron cannot; it conducts heat better than galvanized iron; it makes a lighter colored sirup. (Note: On account of the scarcity of certain critical materials, farmers may not be able to obtain copper or galvanized iron for making evaporators.)

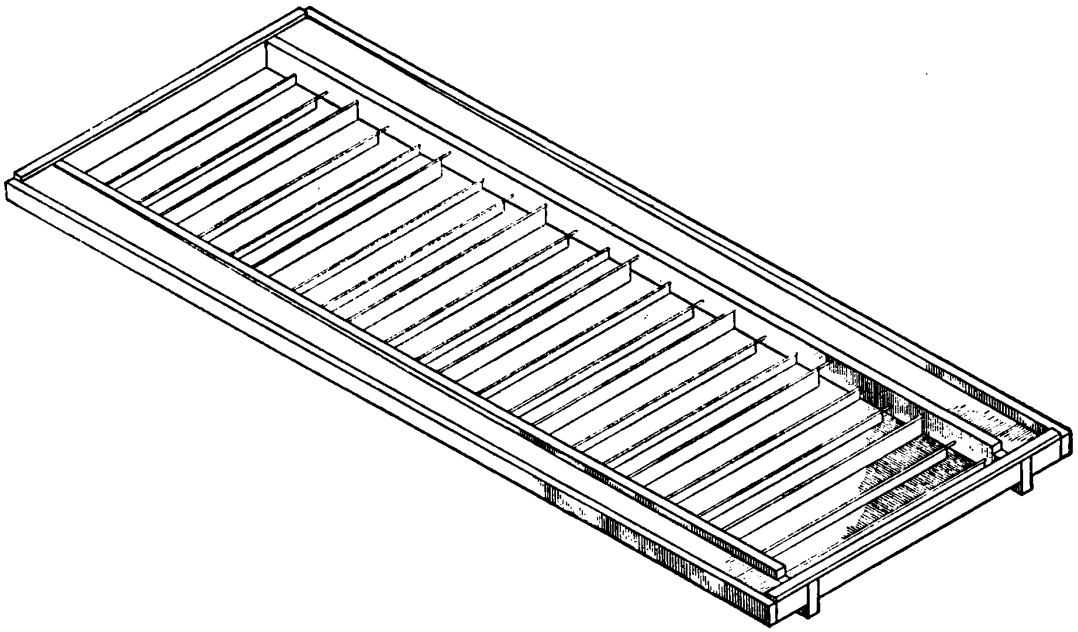

Figure 6.—Evaporator with skimming troughs
(From Farmers' Bulletin 1874, U. S. D. A.)

Skimming troughs save labor and aid in producing better quality sirup. Figure 6 shows the conventional type of evaporator equipped with side skimming troughs. These troughs are a great help as they eliminate the necessity of so much hand skimming all along the sides of the evaporator. They make it possible to produce a brighter, clearer, and less turbid sirup because the skimmers are floated over the evaporator with the foam and are less likely to be boiled in, and they also reduce the loss of sirup. The troughs are attached to the sides of the evaporator using 1" x 4" smooth lumber for the bottoms and sides. Some sirup makers prefer troughs six inches wide. For the troughs to work well it is best to have the side of the evaporator (side bars) not over five inches high, inside measurement.

At the sirup end of the evaporator the bottom of each trough is flush with the top of the evaporator side bar, while at the juice end, the bottom of the trough is one to two inches below the top. This gives the trough a slope toward the juice end, making the skimmings run that way. A crosswise partition in the center of each trough (although not shown in the diagram) prevents mixing of the clarified semi-sirup with the juice. It allows the semi-sirup skimmings to run back into the evaporator through a suitable small opening while the juice skimmings run back to the juice through a small section cut out of the evaporator side bars.

The sirup pan or evaporator should be cleaned thoroughly at least every other day. A better practice is to clean the sides and bottom every night when there is heat and hot water. A clean evaporator is one of the most important factors in making the best quality sirup. Copper evaporators may be cleaned by using a dilute solution of hydrochloric acid (muriatic acid). This solution, when allowed to stand in the pan for a short period, dissolves the sediment so it can be cleaned with a slight scrubbing and running water. Galvanized iron evaporators cannot be cleaned with acid as the iron corrodes badly on coming in contact with the acid.

Of the many types of equipment used for concentrating juice to sirup, kettles are probably the oldest. A product of fair quality results when kettles are properly operated, although, in general kettles are not to be recommended for new sirup plants, since they are relatively inefficient from the standpoints of operating cost, sirup quality, and sirup-making capacity.

The advantages in using kettles for small-scale sirup making are: (1) The density of the finished sirup may be readily controlled; (2) the method requires but little skill; and (3) a long period is available for skimming, thus making it possible to obtain a clean sirup. The disadvantages are: (1) A long period is required for evaporation, frequently 3½ hours or longer; (2) a dark product may be obtained as a result of the prolonged slow boiling; and (3) the sirup-making capacity is relatively small.

The flame must not be allowed to rise above the level of the boiling juice in a kettle; otherwise the sirup will burn and have a scorched taste. Another precaution necessary when making sirup in this kind of apparatus is to concentrate a single charge. Adding fresh juice to the boiling sirup always results in a dark sirup with poor flavor and clarity. After a charge has been concentrated, the kettle should be swung from the fire, the sirup poured out, and the sediment washed out before it has had time to burn. If the kettle cannot be removed from the fire, after two or three charges remove the fire and clean the kettle.

Evaporating to Proper Density

Many sirup operators are able by experience to judge fairly accurately the density of sirup while it is still boiling. No amount of experience, however, can take the place of accurate measuring. One of the best instrumnts used for this purpose is known as the **sirup maker's thermometer.** The first step in using the thermometer is to determine the temperature at which water boils in the particular locality. Sugarcane sirup is usually finished at a temperature 12 to 13 degrees higher than the boiling point of water, if sirup of average density is desired. Sorghum sirup is usually finished at a temperature 14 to 15 degrees higher than the boiling point of water, provided, of course, that sirup of a fairly heavy density is desired. For example, if water boils at 211 degrees, sugarcane sirup should be finished at a temperature of 223 to 224 degrees F., and sorghum sirup should be finished at 225 to 226 degrees F. In checking the temperature of the sirup the bulb of the thermometer should be submerged in the boiling syrup but should not come in contact with the bottom or side of the evaporator. The bulb of the thermometer should be cleaned thoroughly from time to time; otherwise it may not give an accurate temperature reading.

Prevention of Sugaring

Sugaring of sirup after it is made depends largely upon the variety of cane and its maturity. The finished sirup should not be stirred while it is cooling or afterwards because this causes more rapid sugaring.

The Maltase method for making sorghum sirup and the Invertase method for making sugarcane sirup are recommended practices for producing sirup of high quality with a minimum amount of sugaring. In brief, these methods require careful skimming and evaporating of the juice to a half-done or semi-sirup density. The semi-sirup from one day's run is cooled for treatment in a tank of sufficient size to hold an entire day's output. The treating material is mixed with the semi-sirup and allowed to stand for approximately 12 hours. After this period the treated semi-sirup is evaporated to the finished sirup. These methods are adapted to small or large scale production and to the direct-fire or steam-type plant. Detailed plans and instructions for using the Maltase method for sorghum sirup is given in Farmers' Bulletin 1791, "Farm Production of Sorghum Sirup" and plans for using the Invertase method for treating sugarcane sirup are given in Farmers' Bulletin 1874, "Farm Production of Sugarcane Sirup".

Canning

No serious difficulties are encountered in canning sirup on the farm if a few simple rules or suggestions are followed. The three general conditions necessary for successful canning are (1) to fill the cans with sirup at the proper temperature, (2) to obtain air-tight closure of the cans, and (3) to avoid long retention of heat by the sirup both before and after canning.

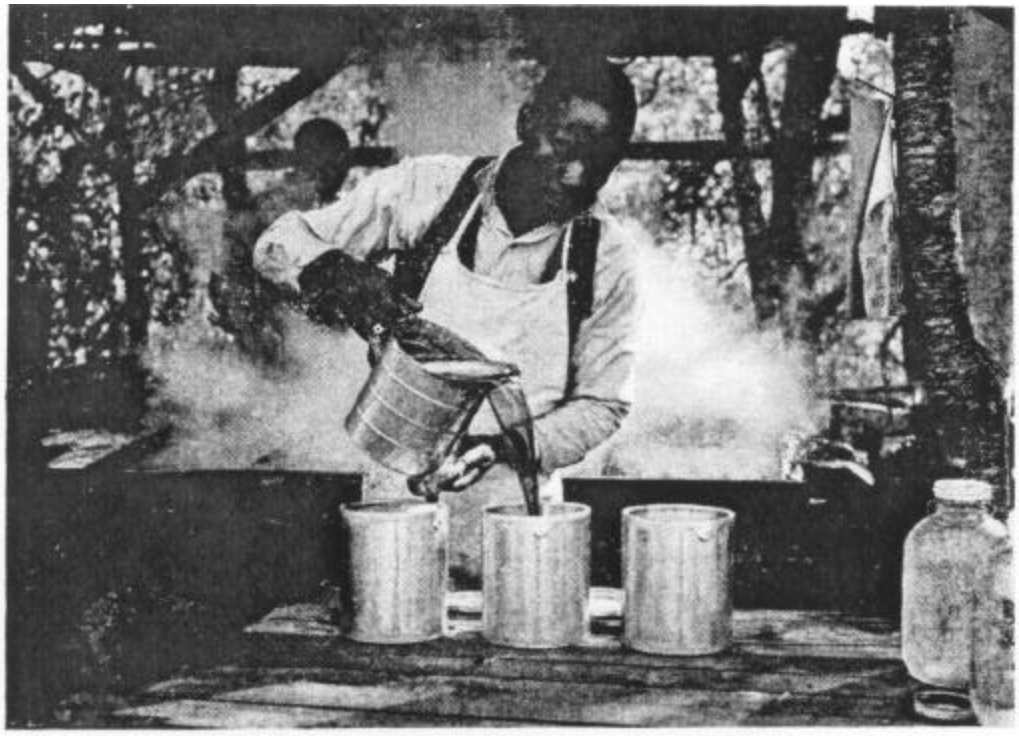

Figure 7.—Canning sorghum sirup

Strain the sirup through muslin or light domestic as it flows from the evaporator, and allow it to cool somewhat either for canning or for barreling. It is best not to can sirup too hot, owing to the injurious effect of high canning temperatures on the quality of the sirup. A cooling trough into which the sirup is run, or poured, which is set high enough off the ground so that sirup can be drawn off by gravity into the cans, is inexpensive and very convenient. Sirup that contains much sediment should be allowed to settle thoroughly, which usually requires an overnight period or sometimes longer. The sirup must, of course, be reheated to the proper temperatures before canning. For half-gallons and smaller cans, the sirup should be canned as closely as possible at 190 degrees F. For gallon cans, fill as closely as possible at 180 degrees F. For barreling, the sirup should be cooled at least 120 degrees F.

SUMMARY AND RECOMMENDATIONS

Recommendations for farm production of sugarcane sirup are outlined as follows:

1. Select a soil which contains an abundance of plant nutrients and humus, one that is well drained but retains moisture well. Light sands and heavy clays are not desirable.

2. A mosaic-resistant variety is not only desirable but necessary. The Co. 290 variety is recommended, also C. P. 29/116.

3. Use liberal applications of a complete fertilizer such as a 4-12-4.

4. Mix the fertilizer thoroughly with the soil in the furrow in which the cane is dropped. Make side applications of fertilizer about the middle of May.

5. Plow under legumes or other crops early enough to permit thorough decay before planting.

6. Barnyard manure injures the quality of the sirup and should be used sparingly, or preferably on the preceding crop.

7. Open deep furrows with a two-horse "middle buster" in four-to six-foot rows.

8. Early cultivation may be relatively deep but later cultivations should be shallow. One to three hoeings are usually necessary.

9. Do not grind cane without removing leaves, since this ordinarily means inferior sirup.

10. Grind the cane and make the juice into sirup as soon as possible after cutting and stripping. In communities having no sirup mills, the county agent will be glad to furnish complete plans for constructing a mill and complete information for making quality sirup.

Recommendations for the farm production of sorghum sirup are as follows:

1. Choose a variety of sweet sorghum that is known to produce quality sirup in the particular locality.

2. Select a well drained soil that will normally produce a good crop of corn or wheat. Avoid acid soils.

3. In general, prepare land as for corn. Plant on a firm seedbed.

4. Apply 400 pounds of mixed fertilizer per acre at planting. Side-dress with 100 to 200 pounds of quick-acting nitrogenous fertilizer per acre when sorghum is about 40 days old. Do not use barnyard manure on sweet sorghum for sirup.

5. Cultivate the same as for corn.

6. Harvest for sirup when the seed are between the soft and

hard dough stage. If too green or too ripe, an inferior sirup will likely result.

7. Strip the stalk and remove all seedheads carefully, else a dark sirup of inferior flavor may result.

8. Grind the stalk and make the juice into sirup on the same day when it is cut, if possible; otherwise, the next day.

9. The sirup-making operation is one of the most important factors governing the quality of the sirup. Follow the detailed recommendations carefully.

10. In communities having no sirup mills the county agent can furnish complete plans and information for making quality sirup.

REFERENCES

The following publications may be consulted for more detailed information:

U. S. Department of Agriculture Farmers' Bulletin 1619, "Sorgo for Sirup Production—Culture, Harvesting, and Handling".

U. S. Department of Agriculture Mimeographed Circular, "Sorghum Sirup—How to Prevent Jellying and Slow Boiling, and How to Prevent Sugaring".

U. S. Department of Agriculture Farmers' Bulletin 1791-F, "Farm Production of Sorgo Sirup".

U. S. Department of Agriculture Mimeographed Circular, "How To Make Best Quality Sorghum Sirup".

U. S. Department of Agriculture Circular 284, "Sugar Cane for Sirup Production".

U. S. Department of Agriculture Bulletin 1370, "Sugar Cane Sirup Manufacture".

Alabama Extension Service Mimeographed Circular, "Improved Methods for Making Sorghum and Sugarcane Sirup".

Mississippi Agricultural Experiment Station Mimeographed Circular 15, "Making Sugarcane Sirup in Mississippi".

U. S. Department of Agriculture Circular 461, "Two New Varieties of Sugarcane for Sirup Production".

U. S. Department of Agriculture Farmers' Bulletin 1874-F, "Farm Production of Sugarcane Sirup".