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MINNESOTA SUGAR PRODUCTS

By J. J. Willaman, Division of Agricultural Biochemistry

THE SITUATION

The various sugar foods are important articles in our diet. Formerly, farmers produced a large portion of their sugar foods on their own places, principally in the form of maple sirup, sorghum, and honey. More recently, granulated sugar has assumed first importance in practically all households for sweetening purposes, owing to its cheapness and convenience. Other forms of sugar, however, are highly desirable for various purposes, especially those which are considered delicacies, such as maple sugar and honey. These being expensive, there is a growing demand for directions for producing these home-grown sugar products.

There are thousands of maple trees in the state distributed in many counties. At one time the making of maple sugar was practiced to a considerable extent, but of late years the industry has been on the decline. The production of maple sugar in Minnesota in 1860 was 370,000 pounds; in 1870, 210,000; in 1880, 76,000; in 1890, 34,000; in 1900, 29,000; in 1910, 11,000. The decrease has no doubt been due in part to cheap and plentiful granulated sugar, and in part to the fact that the people who have settled in Minnesota during the last few decades were not familiar with the work. It is believed that the making of maple products could be revived very profitably. The trees are here; they require no acreage now occupied otherwise; the labor comes in the early spring when other farm work is not pressing; the products are among the most highly relished of all sugar products; and there is always a good demand for them on the market at good prices. The chief drawback to the industry is that the flow of sap depends entirely on weather conditions, and hence the yield is subject to considerable variation from year to year.

Sugar beets are grown rather extensively and profitably in those sections of the state which are accessible to sugar factories. They can be grown in practically all parts of the state, however, and when the process of making sirup from them is more generally known, they will no doubt be a common source of home-made sirup. The sirup is not a commercial product; it is too dark in color to find a ready market. But the ease of growing a small patch of the beets, the simplicity of the process of making a palatable sirup from them, and the fact that the beets can be stored and worked up at any time up to January, recommend it as a sugar substitute.

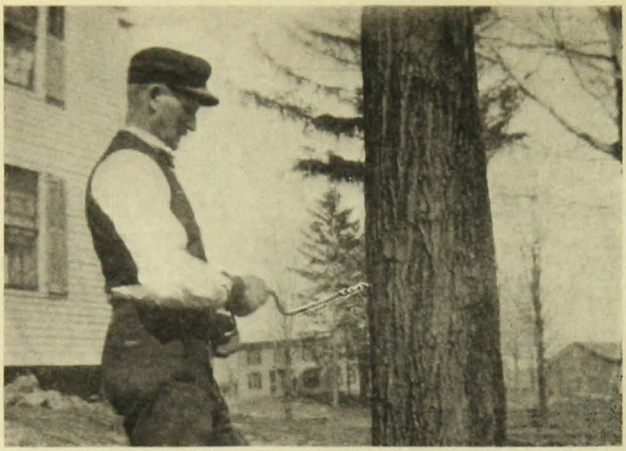

Fig. 1. Tapping the Tree
Note the height of the tap hole from the ground and its upward slant into the tree. (From Farmers' Bulletin 516, U. S. Dept. of Agr.)

Sorghum has long been grown in Minnesota for sirup making, but, like maple sirup, it has experienced a steady decline since 1880. In that year there were 543,000 gallons made; in 1890, 340,000 gallons; in 1900, 157,000; in 1910, 145,000. Here again the effect of cheap granulated sugar is seen. Most of the sirup was made in a small, crude way, and the farmers were glad to abandon the disagreeable work when other forms of sweetening were more readily obtained. As a matter of fact, sorghum sirup making at the present time is not an economical process except on a factory scale. When small mills are used, barely half the juice is expressed; the cane must be headed, stripped and bundled, which requires much hand work; the concentration of the juice in small pan evaporators is a time- and labor-consuming process. In larger steam-operated plants, however, the milling is much more efficient, the cane can be harvested with corn binders and fed into the mill with the leaves on, and evaporation by steam coils produces quick concentration with a consequently better flavored product. In view of these facts, it is probably not advisable to install a plant for sorghum sirup making where less than 2,000 gallons a season would be made. Whether the small plants in use at present should continue to be operated will have to be decided according to local labor conditions; labor can usually be more profitably expended on other crops. The larger mills in existence at present, however, should be run to capacity; and coöperative creameries might well extend the usefulness of their power plants by installing sorghum mills in conjunction with their other work, for the manufacture of sorghum sirup on a large scale is a rather profitable enterprise, and one well adapted to coöperative action.

No doubt the sweetest of all our sugar products is honey. It was probably the first form of sugar to be used by man, and still stands in the front rank as one of the most highly prized sweet delicacies, altho in many places where other sugar is scarce it is an important article of food. From the viewpoint of conservation, it should claim the attention of many more farmers than it now does, for there is but a minimum amount of labor connected with bee keeping; the honey is produced from unlimited natural sources that go to waste entirely unless gathered by bees; and besides forming a delightful addition to the home supply of sweets, there is always a good market for it at very profitable prices.

The situation, then, as regards Minnesota sugar possibilities, is that the tapping of maple trees should be encouraged as a profitable and permanent industry; that sugar-beet sirup is an excellent home-made sugar product, the making of which could be adopted wherever fuel is plentiful; that the making of sorghum sirup on a small scale is not economcial of labor and can not be recommended, but that production on a larger scale could well assume a more important place among the industries of the state; that the keeping of bees can be undertaken either in town or in the country, and is profitable on either a large or a small scale. The following concise working directions will be of assistance in making these sugar products.

MAPLE SIRUP AND SUGAR[1]

The trees.—The sugar or hard maple and the black maple are the only species that can be tapped profitably. Trees less than five inches in diameter should not be tapped; very large and vigorous trees may be tapped in two places, but one tap hole should be the general rule.

The tap hole.—The tap hole is usually placed about waist high on the south or east side of the tree. The bark should be brushed clean before boring the hole. The hole should be between three-eighths and one-half inch in diameter, about two inches deep, and should slant upward slightly. (See Figure 1.)

Fig. 2. The Sugar Bush

Note the position of the buckets on the trees and the covers to protect the sap from snow. (From Bulletin 2B, Canadian Dept. of Agr.)

Time to tap.—In Minnesota the season usually falls between the middle of March and the middle of April. All preparations should be made earlier, however, as the season starts with a rush. Warm, sunny days, with a temperature above 32 degrees F., followed by frosty nights, constitute "sugar weather." The flow of sap is greatly affected by the weather; a long warm spell, a long cold spell, or high winds may check the flow or stop it altogether. The season usually lasts from 20 to 30 days, altho it may last but a few days.

Spouts.—Metal or wooden spouts which fit snugly into the tap hole and do not bruise the bark, which have a hook or lug for holding the bucket, and which will support the bucket clear of the ground, should be chosen. Metal spouts are preferable as they are easier to keep clean.

Sap buckets.—These are also preferably of metal, either heavy tin or galvanized, with little or no solder on the inside. Usually they are sold in 10-

[1] A more thoro discussion of maple products, especially the care of the maple grove, can be obtained by writing to the Division of Publications, U. S. Dept. of Agr., Washington, D. C., for Farmers' Bulletin 516, "The production of maple sirup and sugar."

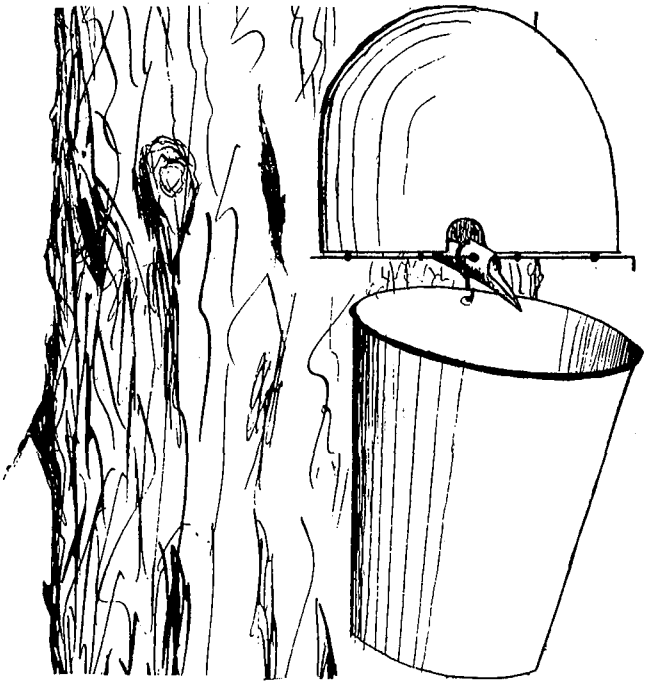

Fig. 3. A Good Type of All-Metal Spout, Bucket, and Cover
All parts are easily removed and cleaned.

to 14-quart sizes. Covers are highly desirable, as rain, snow, insects, and pieces of bark falling into the sap lead to very inferior products.

Hauling tank.—For collecting the sap and hauling it to the evaporator, a large container on a stone boat, sledge, or wagon is necessary. This container may be a barrel or a wooden tank. As these, however, are difficult to keep clean and prevent souring, covered metal tanks with an outlet at the bottom are most desirable. There are several types and sizes on the market.

Evaporators.—Altho the sirup can be evaporated in the open, it is far better to have a building to protect the boiler. If possible it should be large enough to contain also the season's fuel. It should have a good ventilator in the roof which can be easily closed and opened. It should be placed on a hillside, if possible, so that the sap can flow by gravity from the collecting tank on a sledge into the evaporator or into a storage tank. Iron kettles can be used for evaporation, but great care is necessary to prevent scorching, and a mild, pleasant sirup is seldom obtained. The best evaporators are large, oblong, shallow pans resting on a brick, stone, or iron firebox or arch. The pans are made of galvanized iron or copper. Some of them have cross partitions to give a zig-zag course to the sap, the latter flowing in at the fire end and the finished sirup flowing off at the chimney end. (See Figure 4.) There are also patent evaporators on the market which have corrugated bottoms on the pans and dampers for the better control of the fire. The size of evaporator necessary for the size of the sugar bush to be tapped may be computed as follows: 1 square foot of bottom will evaporate about 2 gallons of sap per hour; that is, about 10 square feet are necessary for each 100 buckets set.

The sap.—The flow of sap continues only during favorable weather; it may stop and start many times during a season, each run being a few or many days in length. At the beginning of the season the sap is white and clear. Later it becomes yellow and cloudy and has a peculiar odor. When this condition is so marked that good sirup can not be made, operations must cease for the season. The sap contains from 1 to 4 per cent of sugar with an average of 2 per cent. It also contains nitrogenous matter which enables molds and bacteria to spoil and ferment it very readily.

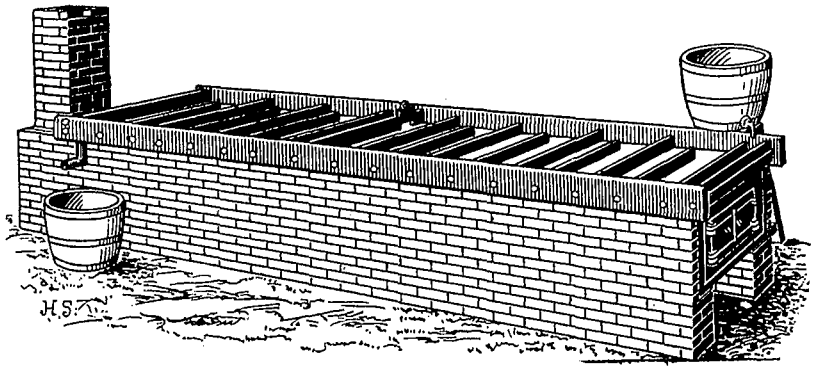

Fig. 4. A Pan Evaporator with Brick Arch
(From Farmers' Bulletin 477, U. S. Dept. of Agr.)

Evaporation.—The sap should be protected from dirt at every point of the operation, since maple sirup is very susceptible to "off" flavors produced by the presence of foreign matter. It should be carefully strained before it is let into the evaporator. The secrets of making good sirup are to evaporate quickly, to prevent overheating and scorching, to remove carefully all scum, and to strain off all the "nitre" or "sugar sand" which forms. If a kettle is used, it should not be filled more than twice before finishing off the sirup, else the long-continued boiling of a part of the contents will produce a dark color and poor flavor. If a pan evaporator is used, the sap should never be more than an inch and a half deep in it. A slight slant towards the back will cause the sap to flow slowly towards the sirup end of the pan. Scum and foam should be removed constantly with perforated metal or fine wire skimmers. As the sap concentrates, a compound called malate of lime, or sugar sand, settles out. Part of this forms a scale on the evaporator, and part remains suspended in the sirup. This can be removed by straining the hot sirup as fast as it leaves the evaporator through felt or double flannel. To judge the point when the sap has been sufficiently concentrated, several methods can be used. An experienced sirup maker can tell roughly by the appearance of the bubbles, but the use of a thermometer or a hydrometer is more satisfactory. A sirup of correct density, that will weigh 11 pounds to the gallon, will boil at 219 degrees F. In taking the temperature, the bulb of the thermometer must not touch the bottom of the evaporator, and it must be completely covered by the boiling sirup. The Baumé hydrometer is usually used to measure the density of sirups. Some of the sirup is poured into a tall cylinder, the hydrometer allowed to settle in it, without touching the bottom, and the point read where the surface of the liquid meets the scale. Hot sirup should read from 32 to 34 degrees; cold sirup 36 degrees.[2]

[2] Hydrometers, cylinders, and thermometers can be obtained through any druggist; they cost from 75 cents to $1.

Care of the products.—It is best to run the hot, strained sirup directly into sterilized containers, either tin cans or glass jars. Wooden kegs and barrels can be used if they are clean and sterile, but such large amounts of sirup are very likely to spoil after they are opened and before they are consumed. Sirup for the market is usually put up in square tins with screw tops in 1-, 2-, and 4-quart sizes. The sirup should be stored in a cool place. Maple sugar should be wrapped in paper and kept in a warm room of even temperature.

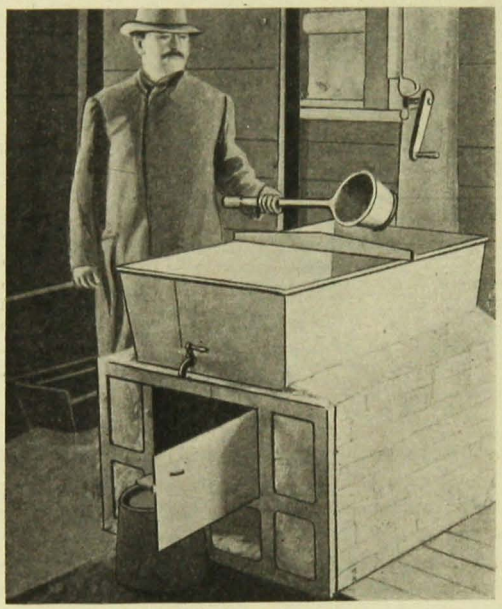

Fig. 5. A Sugaring-off Outfit
(From Farmers' Bulletin 516, U. S. Dept. of Agr.)

"Sugaring off."—If maple sugar is to be made, a special sugaring off pan is required. (See Figure 6.) This is deeper than the evaporating pan. The sirup is run into this pan and then carefully boiled down until it has a boiling temperature of about 238 degrees F., for early runs of sap, and about 245 degrees for the later runs. The pan is removed from the fire, the sirup stirred a few minutes until somewhat cool, then poured into wooden or tin molds to crystallize and solidify.

Cleanliness.—As has been said, maple sap sours very easily. Tap holes become sour and clog, and must then be reamed out clean. Wooden utensils are difficult to keep sweet, hence metal is preferred. All spouts, buckets, and tanks should be frequently cleaned with boiling water, especially during warm weather. Failure to do this will very likely result in poor sirup. The scale or sand must be kept removed from the evaporators, as it insulates the heat and prevents rapid evaporation.

Yield and costs.—The average tree yields about 15 gallons of sap a season, altho there is a very wide variation in this. This sap averages 2 per cent of sugar, and the finished sirup about 65 per cent. Hence a barrel of sap makes a gallon of sirup; or 100 trees should produce 40 gallons of sirup or 300 pounds of sugar. Two men can operate a camp of 500 trees. About 8 cords of wood

are needed for the sap from 500 trees. The cost among eastern makers is estimated at from 50 to 75 cents a gallon for sirup, and from 6 to 9 cents a pound for sugar.

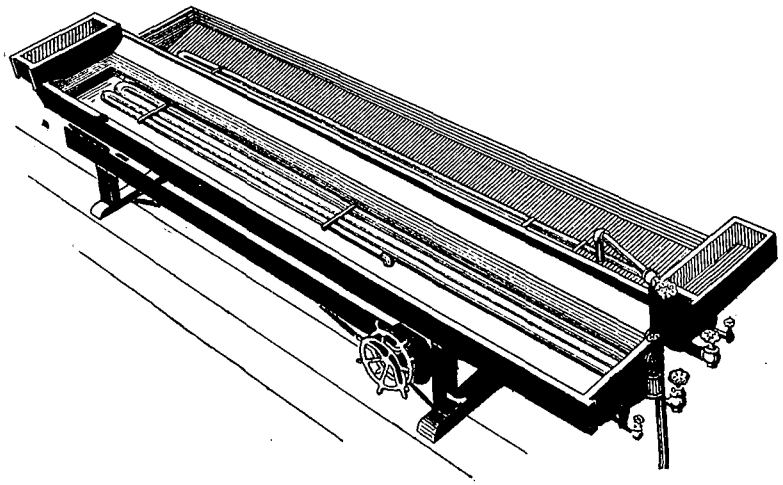

Fig. 6. A Steam Evaporator
(From Farmers' Bulletin 477, U. S. Dept. of Agr.)

SUGAR-BEET SIRUP[3]

Growing the beets.—Any good garden soil is suitable for sugar beets. The seeds are planted when the ground has become permanently warm, in rows 18 or 20 inches apart, and covered rather thinly. After the plants have reached a convenient size, they should be thinned to stand about 10 inches apart. Thoro and frequent cultivation is necessary for the production of beets of high sugar content.

Harvesting.—When the leaves assume a yellowish tinge, and the roots can be pulled from the ground almost free from dirt, they are ready to harvest. Good sirup can be made only from fully mature beets. The roots are pulled or dug and the leaves cut off at the crown. The roots can be made into sirup at once, or they may be stored for several months if more convenient. They are most easily stored by throwing them into a pile and covering them with soil. At first the covering may be light, but later should be heavy enough to prevent freezing.

Preparing the roots for sirup.—The beets should be scrubbed free of dirt, then the crown cut off at the point of the lowest leaf scar. This upper portion of the beet contains such a large amount of mineral material that it imparts a bad taste to the sirup. The roots are then cut into slices as thin as possible. A kraut cutter fastened over a barrel, or a rotary vegetable slicer, or even a sharp carving knife will do the work.

Extraction of the sugar.—The slices should be put in a barrel or wash boiler, covered with boiling water (about 10 gallons of water for the slices from a bushel of beets), and allowed to stand for about an hour, the container being blanketed with burlap or rugs to retain the heat. The beets will cool the water to about 165 degrees F., the proper temperature for extraction. The slices must not be boiled in this water. The water is then drawn off and strained through cloth into a kettle or wash boiler for evaporation.

[3] Compiled from Farmers' Bulletin 823, U. S. Dept. of Agr.

Evaporation.—The boiling down should proceed slowly, and all scum be carefully removed as fast as formed. Scorching, of course, must be strictly avoided. When the sirup has been sufficiently concentrated, it is poured while hot into sterilized glass jars or tin cans and closed tight. The finishing point of the sirup can be judged by pouring some into a cup, cooling, and noting the consistency, or it can be boiled to 219 degrees F., if a thermometer is at hand. If a hydrometer is used, the finished sirup should read 33 degrees Baumé when hot, or 36 degrees when cold. The operator should be particular about getting the proper finishing point, since in using the following recipes success will depend considerably upon having sirup of the consistency given above, which is that of a sirup containing 65 per cent of sugar, and weighing 11 pounds to the gallon.

Yield.—A bushel of good beets will make from 3 to 5 quarts of sirup. A row of beets 35 feet long will give a bushel of the roots. The fuel is the only real item of expense involved; hence the making of this product will probably be profitable only where wood is abundant.

Uses of beet sirup.—The sirup is too dark for a commercial product; but as it is very sweet it can well be used for all cooking purposes where a dark color is immaterial. Most people will relish it as a table sirup. For certain kinds of candy it is excellent.

Recipes for Using Beet Sirup[4]

The following recipes have been found very successful in the use of beet sirup in place of granulated sugar. One cup of sirup contains the same amount of sugar and the same sweetening value as a cup of granulated sugar.

Recipes are worked out on a basis of 1 quart of sirup weighing 44 ounces, or 1 cup weighing 11 ounces.

Steamed Pudding

1 cup sour milk
1 cup beet sirup
⅓ cup fat
1 egg
1 teaspoon soda
1½ teaspoons salt
½ cup raisins
3 cups white flour

Steam three hours in oiled molds.

Steamed Brown Bread

1 cup cornmeal
1 cup bread crumbs
½ teaspoon salt
¾ teaspoon soda
1 cup sour milk
½ cup beet sirup

Mix the cornmeal, crumbs, salt and soda. Add to sour milk and molasses. Steam three or four hours. Bread may be dried off in the oven for about fifteen minutes.

Rolled Oats Drop Cookies

1 cup beet sirup
¾ cup melted fat
⅔ cup sour milk
¾ teaspoon soda
2 cups raw rolled oats
2¼ cups white flour
½ teaspoon cinnamon
½ teaspoon cloves
½ cup cut raisins

Mix the ingredients in the order in which they are given, sifting the dry ingredients together. Drop the cookies by small spoonfuls on oiled pans and bake them in a moderate oven.

[4] The uses of beet sirup for cooking were thoroly worked out by Mrs. Jean M. Dorsey and Miss Mabel McDowell of the Division of Home Economics, University of Minnesota.

Filling

Make a filling of ground raisins, dates, figs, or any other fruit. Moisten with beet sirup until proper consistency to spread. Lemon flavoring may be added if desired.

Soft Ginger Cookies

2 cups beet sirup
1 cup fat
⅔ cup sour milk
4 teaspoons soda
2 eggs
10 cups white flour
3 teaspoons ginger

Mix first three ingredients, add the beaten eggs, add dry ingredients mixed and sifted.

Gingerbread

1 cup sour milk
1 egg
¼ cup fat
1½ cups beet sirup
2½ cups flour
1 teaspoon soda
½ teaspoon baking powder
½ teaspoon salt
1 teaspoon cinnamon
2 teaspoons ginger
1 teaspoon allspice

Beat the egg. Add sirup, melted fat or oil, and sour milk. Sift dry ingredients and mix with liquid. One cup raisins may be added if desired. Pour into a shallow oiled pan and bake in a slow oven.

Apple Sauce Cake

½ cup fat
1½ cups beet sirup
2 cups unsweetened apple sauce
½ teaspoon soda
3 teaspoons baking powder
½ teaspoon salt
½ teaspoon cloves
¼ teaspoon nutmeg
1 teaspoon cinnamon
5 cups white flour
1 cup raisins

Mix ingredients in order given. A half cup of nuts may be added. Bake in shallow oiled pan in moderate oven.

Spice Cake

½ cup fat
¾ cup beet sirup
1 egg
1 cup sour milk
2¾ cups white flour
½ cup raisins
½ teaspoon soda
1 teaspoon baking powder
½ teaspoon salt
¾ teaspoon allspice
¾ teaspoon cloves
¾ teaspoon cinnamon
¼ teaspoon nutmeg

Mix the sirup and softened fat and add the beaten egg. Mix dry ingredients and add alternately with milk to the first mixture. Bake in moderate oven.

SORGHUM SIRUP

Growing the cane.—Early Amber is the best variety of sorghum for Minnesota. It should not be planted until after corn, as it is not a vigorous plant at first, and must not be retarded by bad weather. The rows should be from 36 to 40 inches apart, and the seed evenly distributed 6 or 8 inches apart in the row. From 5 to 7 pounds of seed per acre are required. Very frequent cultivation should be practiced.

Harvesting.—The cane can be used from the time the seeds are in the soft dough stage. The sap is better at the later stages, but in order to avoid frosting, operations should be begun as early as possible. The seed heads are

removed in the field. If horse power or light machine power is used in pressing the cane, the leaves also must be removed. The bundled canes can be worked up immediately or piled or shocked for several days. In cool weather a week or more will do no harm. Frosted cane must be used immediately.

Extraction of juice.—Light, two-roller mills are very wasteful of juice; they never recover more than 800 pounds of juice per ton of cane. Three-roller mills, power driven, will recover as much as 1,200 pounds. With the latter, the leaves may be left on the cane without any appreciable harm.

Clarification of juice.—The juice should be strained as it comes from the rollers. From this point on two general processes are practiced. The first is direct clarification and evaporation, at the same time, by heat alone. The juice is led into the evaporator, boiled down slowly, skimmed carefully, and the finished sirup run into containers. This method almost always produces a dark colored, strong sirup. It can be much improved by providing barrels or tanks in which the juice is heated, preferably by a boiler or feed cooker, up to the boiling point, the heat turned off, and the juice allowed to settle. The clear juice is then run off through a swing-pipe, or through a faucet opening several inches above the bottom of the container, and then evaporated.

The other method involves treatment with milk of lime to neutralize part of the acidity of the juice and to cause a better settling of the impurities. The milk of lime is made by slaking 10 pounds of quick lime with 2 gallons of water, adding 8 gallons of water, stirring well, and straining through a one-eighth-inch screen. This is added to the juice at the rate of 1 pint for each 16 gallons of juice. The lime must be thoroly stirred each time before using any of it for defecation. After adding the lime, the juice is well stirred, heated to the boiling point, allowed to stand until settling is complete, then the clear liquid drawn off as in the other method and evaporated. This involves two and preferably three tanks. While one is filling, the juice in another is settling, and that in the third is being drawn off for evaporation. This method gives a better grade of sorghum sirup than any other, it being light in color, mild in taste, and usually fairly clear. Less satisfactory results can be obtained by simply adding the lime and then evaporating without settling. Since the compounds of lime that are formed are not completely removable in the scum, the sirup is darker and more bitter than if settling first takes place.

Evaporation.—The methods and apparatus used for sorghum are similar in every respect to those used for maple sirup. The finished sirup has a boiling point of 221 degrees F., and a density of 38 degrees Baumé, when cold, altho some people prefer a heavier sirup. The sirup should be cooled rapidly to prevent darkening, and should be allowed to settle, if possible, to remove sediment that could not be skimmed off.

Yield.—From 6 to 15 tons of cane per acre can be grown. From 10 to 13 gallons of sirup per ton can be obtained, depending upon the completeness of the extraction and the sugar content. That is, an acre of cane will produce from 100 to 200 gallons of sirup, with the average about 150. With labor figured at $4 a day, the cost of sorghum sirup, including growing the cane, preparing it for the mill, and making the sirup, is about 80 cents a gallon for small-scale production (2,000 gallons or less a season), and 40 cents a gallon for large-scale production (15,000 gallons or more a season).

HONEY

By Francis Jager, Division of Bee Keeping

Honey is the nectar of flowers, gathered, modified, and stored by the honey

Fig. 7. Maple Sugar and Honey From the Same Acre

bee. Flowers produce nectar to entice the bees to visit them, in order that the bees with their fuzzy bodies covered with pollen grains may cross-fertilize the blossoms. The drop of nectar is her pay for doing this work. The bee visits only one kind of flowers on one trip. Clovers, basswood, fireweed, mints, fruit trees, etc., depend upon the bee for fertilization. These plants also are the chief sources of honey in our state.

Nectar is composed of cane sugar and about 60 per cent water. During the process of storing and ripening the nectar the bee evaporates most of the water, leaving only about 20 per cent in the finished product. She also changes the cane sugar of the nectar into invert sugar. The honey is stored in hexagonal wax cells manufactured by the bees for that purpose.

The amount of honey produced by bees in Minnesota has never been ascertained. Most of the honey crop is consumed in the locality where it is produced. About two million pounds find their way into the markets in an average year. According to Phillips, the honey crop of the United States is worth $20,000,000 a year. By far the greater proportion of nectar is never gathered because of lack of bees, especially in the northern part of the state. Estimates place the amount of nectar lost every year all the way from 10,000,000 to 20,000,000 pounds. This loss of more than $2,000,000 is just as serious a waste as if a farmer would not harvest his wheat, or not dig his potatoes, for lack of tools. The nectar is there, produced by nature, and ready for harvest; but there is insufficient equipment to gather it.

For honey production purposes, the state may be divided into three parts, the "big woods" or the southeastern part of the state, the "cut-over lands" of the north, and the prairie land of the west.

The sources of honey in the southeastern district are dandelions, fruit trees, white clover, basswood, alsike and sweet clover, goldenrod, and asters. In an average season an experienced beekeeper in this district may gather from 75 to 100 pounds of surplus honey from one colony of bees.

In the cut-over territory of northern Minnesota, clover, wild raspberry, wild cherry, sweet clover, goldenrod, aster, and fireweed are the principal honey plants. Fireweed springs up in great abundance the second year after forest fires go through a district, and it is one of the greatest honey plants of America. Records show that, twenty miles from Duluth, a colony of bees has produced a surplus of 200 pounds of honey in one season. The area burned over in

the fall of 1918 will become for the next five or more years the greatest nectar producing area of the state. Unless somebody sees the opportunity of securing this crop it will go to waste. There are almost no beekeepers in this district.

The western prairie lands furnish honey from white clover, mint, goldenrod, and asters and will give in an average season from 30 to 50 pounds of surplus honey.

According to the Government report, the average amount of surplus honey per colony for 1916 was a little more than four pounds. The reason for this low average is that about 90 per cent of the beekeepers of the state are merely "hive owners" without the qualifications, knowledge, or inclination to give the bees that attention which is required for any other department of modern farm work to make it a success. Such men harvest very little honey, if any.

Bees are highly specialized animals with absolutely set habits. For successful beekeeping a very thoro knowledge of bee habits and instincts is required. In addition to this the beekeeper must familiarize himself with modern bee tools and equipment, local botanical and geological conditions, and problems of management, swarming, wintering, and disease.

The best way to keep bees on the farm is to put them in charge of one member of the family. A boy or girl with ambition will find bees an opportunity for making a living. It takes money to secure land, build barns, and buy machinery, and some of our young people are rather short of this necessity. It takes very little capital to start in beekeeping. Bees require no expensive buildings, machinery, or land. A strip of land 50 x 50 will hold one hundred colonies. For pasture they go to the neighbors' fields for five miles around and bring home the stolen sweets. They provide thier own feed for summer and winter, and rare are the occasions when the beekeeper must help them through the winter with a few pounds of sugar. The housing and feed expense being practically nothing, there is proportionately a greater return from an investment in bees than in any other branch of farm industry.

One should begin beekeeping with from two to five hives of bees of a pure strain, and in modern hives. Five colonies of bees, with all tools and equipment, should not cost more than $75. From this nucleus one may gradually increase up to 100 or even 300 colonies, as experience is acquired and as returns from honey crops are obtained. One person can manage from 50 to 300 colonies, according to ability and time.

Besides bees and equipment to obtain success, we recommend the following:

1. Procure one or more good bee books; read them and study them. You will find them not only instructive, but highly interesting.

2. Subscribe to one or two bee journals.

3. Join the Minnesota Bee Keepers' Association and come in contact with men and women who have been successful in beekeeping.

4. Take a short course at University Farm, or a complete course of one year, offered in both the School and College, at University Farm.

5. Write to the Bee Division, University Farm, when in need of advice.

We do not need more beekeepers in the southern part of the state, but we need many better ones. In the northern part we need a large number of good ones. By encouraging able young men and women to become good beekeepers, two services are performed: a splendid opportunity is being presented to those who are looking for one, and a beginning is made to save millions of pounds of honey now going to waste.