UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION
M. F. Miller, Director

CIRCULAR 235 Columbia, Mo. MAY, 1942

Growing Sorghum and Making Sorghum Sirup

C. A. Helm and Robert Beasley

SORGHUM PRODUCTION

Varieties

Orange, Sumac, Honey, and Black Amber are the four best varieties of sweet sorghum to use in Missouri. Orange is most commonly used and is generally well adapted throughout the entire State. In extreme northern Missouri, especially for late planting, Black Amber may be used, but under normal conditions use Orange.

From Central Missouri southward Sumac and Honey are also well adapted, and in extreme southern Missouri and in southeastern Missouri Honey is especially well suited. As to maturity, Amber is early, Orange and Sumac medium, while Honey is comparatively late.

Soils

For sirup production select soils with good drainage, preferably sandy loam. Do not plant on heavy, poorly drained land. Land of at least medium fertility is desirable. Do not apply manure, as this will have an unfavorable effect upon the quality of the sirup.

Seedbed Preparation and Planting

Prepare the ground the same as for corn. Delay the planting of sorghum until two to three weeks after normal date of planting corn. Plant sorghum very shallow, no deeper than necessary to secure even and complete covering of the seed. Plant with regular corn planter using special sorghum plates, at the rate of 6 to 10 pounds of seed to the acre, the actual rate depending upon the known germination percentage of the seed being planted. A thick stand in the row should be avoided. Plants spaced on the average every 8 to 10 inches in the row are preferable to thick stands.

Harvesting

Sorghum should be harvested during the late milk to the medium dough stage for best quality sirup. Strip all leaves and cut all seed heads from the stalks before taking to the mill. Do not cut more sorghum than can be processed by the mill in two days and if weather is hot it should be processed as soon as possible after cutting. Frosted sorghum should be processed as soon as possible for decomposition sets in quickly upon thawing. If shocked to prevent freezing care must be taken to see that heating does not take place. Both frosting and heating impair the quality of the sirup.

Yield per Acre

The yield of sorghum may be as high as 15 tons or as little as 4 tons per acre. A ton of sorghum should produce from 8 to 20 gallons of sirup. The per acre yield usually reported ranges from 75 to 150 gallons of sirup per acre. The yield of sirup depends on the kind of mill, the care used in milling and processing, the variety of sorghum, the attention given to seeding, cultivating and harvesting, and the kind of growing season.

SORGHUM MAKING

Location, Lay-out, and Size of Plant

The plant should be easily accessible to those bringing in the crop and fuel. It should be near an abundant supply of water, so that equipment can be washed often, as cleanliness in sirup making is very important. The evaporating pans are usually covered with a suitable roof and movable shields are used to prevent wind blowing too strongly over the pans. Covers for containers should be used to protect contents from dust and insects.

A hillside layout is best for small plants. The mill should be placed on the highest level, the raw juice run through pipes into tanks below, and the evaporating pans placed still lower. Good drainage should be provided so conditions will be as sanitary as possible. A plan of a simple hillside lay-out is shown in Fig. 1. The juice flows from the mill through a coarse screen into a small juice box, 4 cubic feet being large enough. A 1¼ inch pipe carries the juice from this box to the juice settling tanks. Juice entering the settling tanks is strained through a coarse sack, or through a wire screen suspended in the tanks, to remove crushed leaves, seed, etc. Three juice-settling tanks each large enough to hold a 2-hour juice supply from the mill should be provided for settling the cold juice. While the juice is settling in one tank, the evaporating pans are being supplied with a previously settled lot and juice from the mill is running into the third tank. Care should be taken to remove as much as possible the impurities of the cold juice by settling before it is run into the evaporating pans.

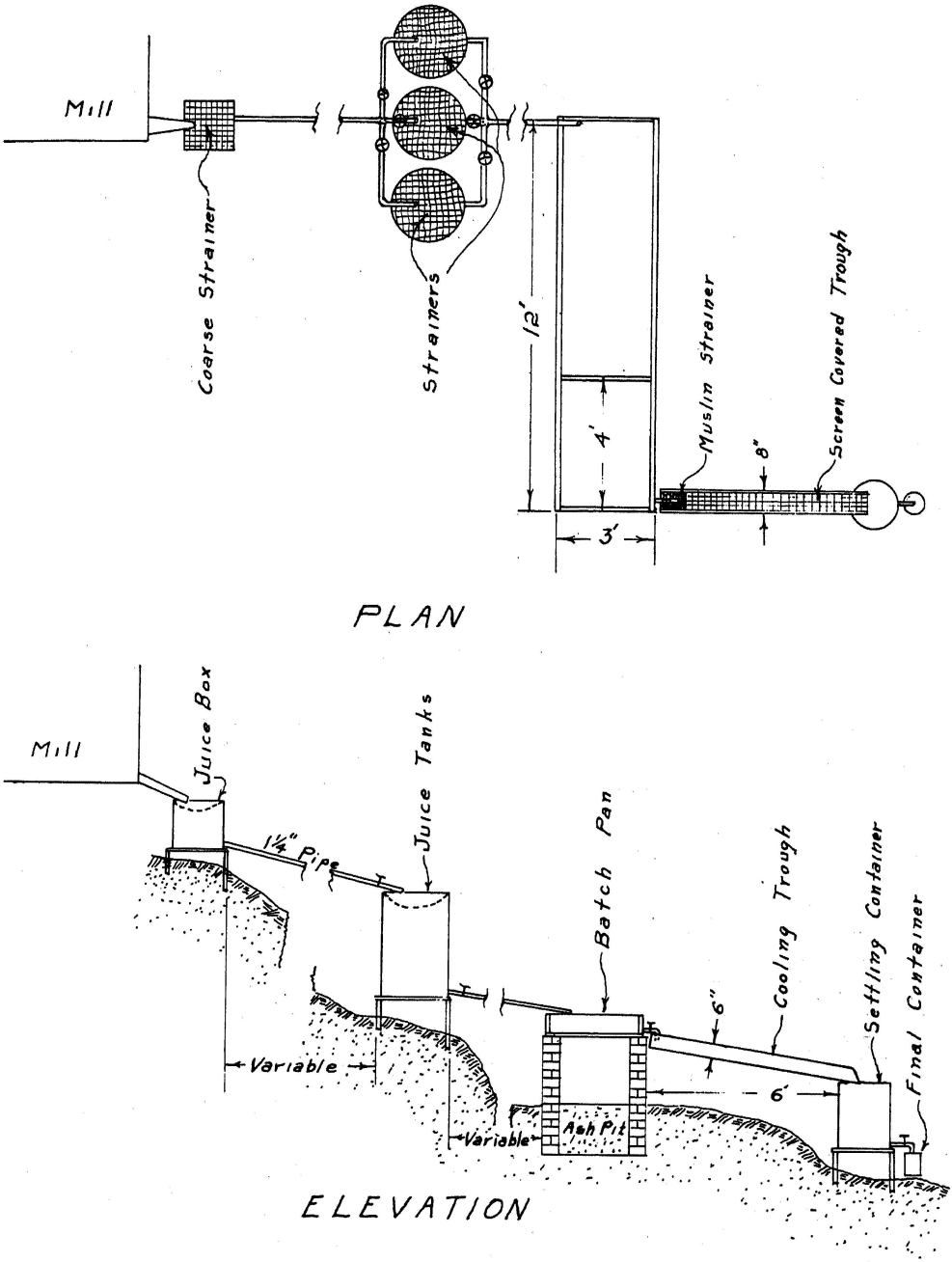

Fig. 1.—Hillside layout of a sorghum plant.

The size of the mill, engine and evaporating pans should be chosen to permit economical operation. The sirup-making season usually lasts five or six weeks, during which period a horse-driven mill, can handle a season's output ranging from 1500 to 2500 gallons of sirup. A power mill, with a large evaporator, is adequate for a 10,000 gallon output.

Extracting the Juice

The juice is obtained from sorghum by running the stalks between the iron rollers of a mill which usually contains three rolls. Care in setting up the mill and adjustment of the rolls before starting is necessary to obtain good extraction and avoid breaking of parts.

The "feed" or quantity of stalks in the mill at one time should be light or heavy according to the adjustment of the rolls and for best extraction should be uniform at all times.

Evaporating the Juice

The quality of the sirup may be influenced to a great extent by the equipment and process used in manufacture and by the skill of the sirup maker. When heat is applied to the juice much of the starch is made soluble, but certain proteins and other non-sugar substances become coagulated and either settle or rise to the surface. This material which rises to the surface should be removed as quickly as possible by skimming. If allowed to boil these coagulations will break down making skimming difficult and resulting in a poorer quality sirup.

Kettles may be used to produce a satisfactory sirup on a small scale, but a long period of time is necessary for evaporation and this results in a dark sirup. In making sirup in a single kettle one batch must be completed before additional juice is added for fresh juice added to boiling sirup results in a dark colored, poor flavored product.

Batch pans 8 to 10 inches deep made of 1½ inch lumber with a bottom of copper, galvanized iron, or sheet metal carefully luted to the sides, can be constructed on the farm and are used by many small scale sirup makers. A quicker evaporation of the juice is obtained than is possible with kettles, hence more sirup can be produced per day. A single pan may cover the entire space occupied by the furnace, or two or three single pans may be used, or a large pan may be divided into two or three compartments. The juice is dipped from one pan to the other as the sirup reaches the stage desired, or some of the larger pans with compartments have gates through which the juice is passed. With a single pan the juice is added and boiled to its correct concentration and removed before additional juice is added. The impurities rise to the top as heating proceeds and should be removed with a wide perforated skimmer. In pans of more than one compartment, or where more than one pan

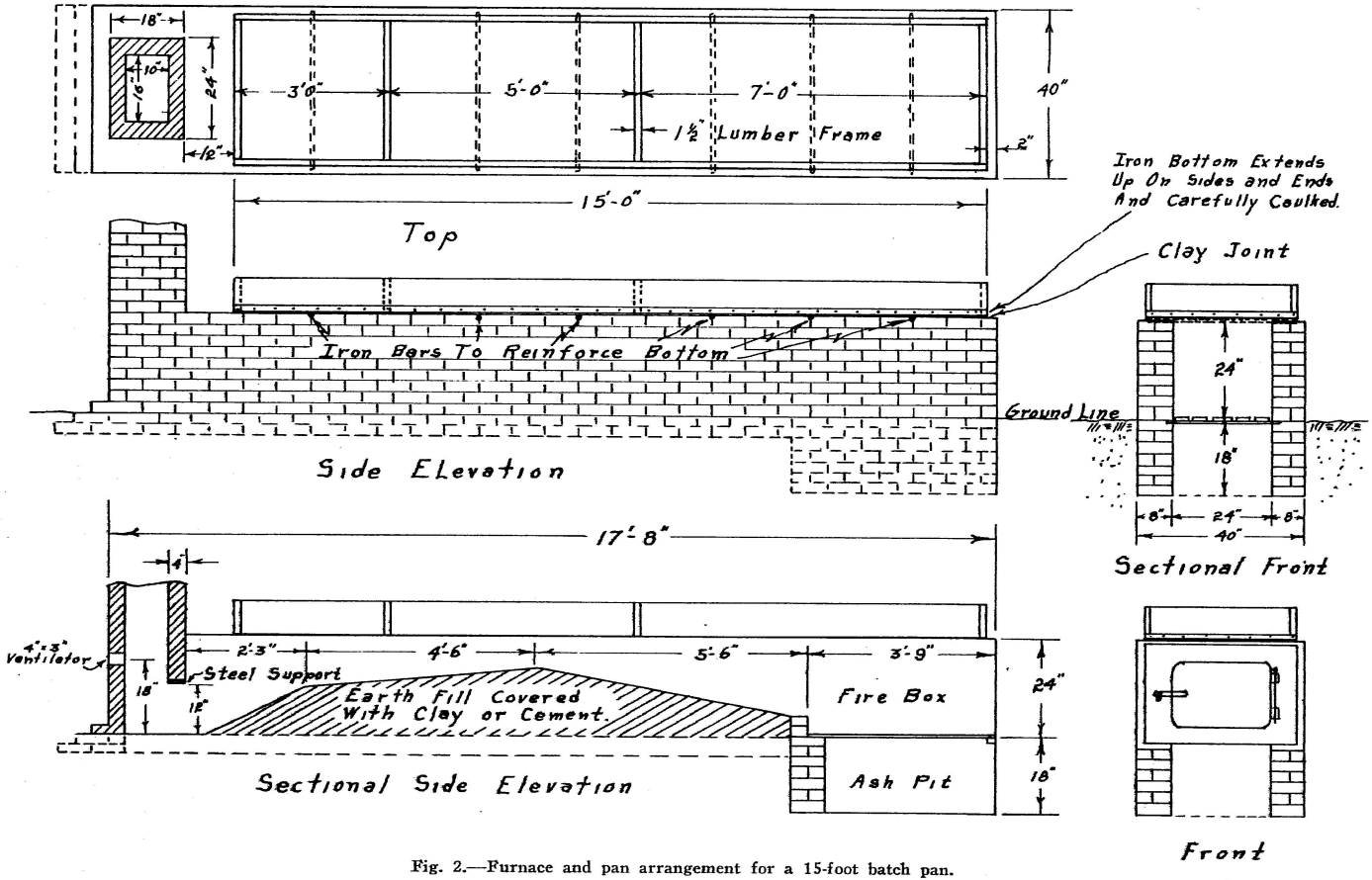

Fig. 2.—Furnace and pan arrangement for a 15-foot batch pan.

is used, the juice from settling tank enters the coolest compartment, this juice has a smooth surface over which the scum forms a blanket and is removed by skimming. As the juice reaches the desired concentration it is dipped, or passed, to the next compartment and fresh juice added to the first pan. In the second compartment further impurities are removed and at the correct concentration this juice is moved to the finishing compartment. The time at which the juice should be passed from one pan to the next must be learned by experience. The compartment or pan into which the cold juice is run should be the larger and the one where the sirup is finished should be the smaller. When two pans, or pans of two compartments, are used the cold juice pan should be about twice the size of the finishing pan. Fig. 2 shows relative sizes for a three compartment pan. With a single pan 32 inches wide and 10 feet long about 15 to 20 gallons of sirup can be made in a 12 hour day. With a larger pan 36 inches wide and 15 feet long, having three compartments. about 40 to 50 gallons of sirup can be made in 12 hours.

For the larger scale operators who wish to produce 75 gallons per day or more the continuous evaporators are most satisfactory. These evaporators, constructed of galvanized iron or copper, are shallow and have crosswise baffles in the bottom which enables a much quicker concentration of the juice than is possible with batch pans. More skill and attention is required in the operation of the evaporator to prevent scorching and to produce a sirup of uniform density than is required with kettles or batch pans. This type of evaporator cannot be made satisfactorily on the farm but may be purchased in various sizes from dealers.

Furnace

The furnace must be properly constructed and carefully fired if a good quality sirup is to be secured. The furnace to give maximum heat and rapid evaporation should be constructed with a good fire box, good grate bars and with the earth so sloped beneath the pan that the hot air will pass close to the pan, near the point where maximum heat is desired, and draw away from it at the finishing end to enter a low flue. A door to the draft chamber insures a good draft of air from beneath the grate. The liability of scorching the sirup at the finishing end of the pan is reduced by having the opening into the flue rather low so as to draw down the air current. See Fig. 2 for a plan of a furnace and simple pan arrangement.

The Finishing Point

The thermometer is very useful in determining when the sirup has reached the correct density. Ordinarily when the temperature of the sirup has reached 15 degrees above the boiling point of water, the sirup is finished. Water should boil at 212° F. at sea level, 211° F. at an altitude of 500 feet, 210° F. at an altitude of 1000 ft. For every

500 ft. of elevation above sea level the boiling point of water is lowered approximately 1° F. The density of the sirup may also be checked by a sirup-maker's Baumé hydrometer, a density of 35° to 37° Baumé is usually desired, if tested at near boiling temperature. Sirup of this density at ordinary temperature weighs about 11.5 pounds per gallon.

A Missouri sorghum-making plant with the proper hillside layout.

Cooling and Canning

Overcooking tends to darken the sirup and a better color will be retained if the sirup is cooled somewhat before it is canned. Instead of drawing the sirup directly into containers it can be cooled considerably by causing it to flow from the pan through a muslin strainer into a screened trough about 6 feet long, through which it runs by gravity into the containers. For gallon containers sirup should be canned at a temperature of 180°, and for barreling the temperature may be as low as 120° F.

The Use of Malt

Malt extract of high diastasic value is beneficial in correcting some of the trouble in making sirup from cane of poor quality. Starch in the juice tends to keep the sirup from reaching the proper boiling point; it is also the cause of jellying or clabbering of the sirup on standing. For further information in regard to the use of malt or other phases of constructing and operating a sorghum sirup plant consult U.S.D.A. Farmers' Bulletin #1791 "Farm Production of Sorgo Sirup."