In working out a system of cropping to determine the number of stubble crops that may be profitably made, the grower needs to be on guard against drawing general conclusions from the operations for a single year, but should be guided by the average of results for all crops harvested from the initial planting. Nevertheless, his elements of cost and his crop receipts are figured each year to serve as the basis for calculating the average results.

Considering first the plant-cane crop, the record of labor and work-animal requirements in table 3 may be helpful to the inexperienced planter in arriving at an estimate of these requirements. It is based on field operations in southern Georgia by a farmer cultivating 35 to 50 acres of cane each year, and on sirup making by representative farmers with small power mills and continuous-stream evaporators with capacities of about 200 gallons per day of 12 hours.

TABLE 3.—*Labor and mule requirements, per acre of plant cane grown, in sugarcane growing and sirup making*

Operation	Labor		Mules
	Men	Women	
	Days	*Days*	*Days*
Breaking the land, 1 man and 3 mules with a disk plow breaking 2 acres a day	0.5		1.5
Harrowing	.2		.6
Laying off, marking, and opening the furrows	.5		.8
Planting the cane, with a force sufficient to plant 6 acres a day, including getting the cane out of the banks, stripping it, cutting it into short lengths, and trimming off diseased portions (2 men and 22 women); hauling the cane (4 men and 8 mules); hauling fertilizer (1 man and 2 mules); distributing the fertilizer and covering the cane (2 men and 2 mules); dropping the cane into the furrows (6 women); a total of 9 men, 28 women, and 12 mules to plant 6 acres per day, hence per acre	1.5	4.7	2.0
Hoeing twice by hand		2.0	
Cultivating 6 times (1 man and 1 mule covering 3 acres a day for each cultivation)	2.0		2.0
Second distribution of fertilizer	.3		.4
Harvesting, including stripping, topping, and cutting	6.0	12.0	
Hauling to mill, assuming a haul averaging three-fourths of a mile, 1 man and 2 mules hauling 8 loads (about 10 tons) a day, and a yield of about 22 tons per acre	2.2		4.4
Total days' work to produce the plant-cane crop, delivered at the mill	13.2	18.7	11.7
Grinding the cane and boiling the sirup (a crew of 4 men, including 1 expert sirup boiler, making about 200 gallons a day)	9.6		
Total days' work to produce the crop and make it into sirup	22.8	18.7	11.7

From this report it appears that about 13.2 days' work of men, 18.7 days' work of women, and 11.7 days' work of mules were required to produce 1 acre of plant-cane crop, and that it would require about 9.6 additional days' work of the men to make it into sirup on a small outfit. If mules are used in place of the engine to do the grinding, it would require at least two mules continually, or about 4.8 additional days' work of mules per acre of plant cane put through the mill. For the old varieties of cane, such as Louisiana Purple, Louisiana Striped, D-74, and Simpson, which were formerly grown for sirup production, and the C.P. 29/116, now popular, the harvesting requirements would be about one-half of those here stated, which are based upon the slender-stalk variety, Cayana, which is now widely grown throughout the sirup-producing States. Harvesting

requirements for the varieties Co. 290, C.P. 807, and P.O.J. 213, the culture of which has greatly increased subsequent to 1930, would be intermediate.

The foregoing report of labor which this farmer required for the field operations does not include the time of the overseers. He employed two overseers on the cane crop continuously during planting, and irregularly at other times.

A material saving in labor for grinding the cane and manufacturing the sirup can be effected when sirup manufacture is carried on upon a large scale, though in the case of large outfits necessitating the hauling of cane for longer distances, such saving may be offset to some extent by the increased cost of hauling.

In the case of stubble crops the expense of breaking land and preparing the seed bed and cost of seed cane and planting is omitted. The saving is offset to some extent by the small amount of work involved in wrapping the stubble for winter protection if the grower follows this practice, and in off-barring and removing excess soil in the spring. The cost of these operations is small compared with the cost of establishing a plant-cane crop. In addition, the actual outlay for harvesting, hauling, and sirup making on an acre basis is reduced in nearly the same proportion as the yield and, therefore, the investment during the stubble crop year is considerably less. It must be borne in mind that receipts will probably be less and such saving in per acre cost must be recognized as deceptive, especially if the yield has fallen off considerably. The lower the yield of cane the higher will be the cost per ton, and this principle, carefully applied, will determine whether an additional stubble crop should be grown or whether the investment in a new plant-cane crop is justified. The most carefully planned sirup farm operation is no less subject to risk than farm operations in general, due to weather hazards, fluctuation in the price of sirup, and other factors, and growers can only make judicious use of the facts brought out in records and apply them in making decisions as to continuation of stubble crops.

These considerations emphasize the advantage of growing varieties of cane that may be expected to give high returns because of high-yielding stubble crops, thus avoiding the great expense of frequent replanting. As already mentioned, Cayana, P.O.J. 213, C.P. 807, C.P. 29/116, and Co. 290, when grown under favorable conditions, with attention to the plant-food needs, will afford profitable first- and second-year stubble crops and frequently more, but under present conditions the varieties subject to great injury from the recently introduced diseases gives disastrously low yields even as first-year stubble.

MARKETING THE SIRUP

Considerable quantities of the cane sirup produced annually are packed in cans or bottles by the producers and sold direct for local consumption or to local dealers in food products, but the greater part is packed in barrels and sold to dealers, jobbers, or concerns engaged in the sirup-packing business. It is usually marketed within a few weeks to 2 months after having been produced and is sold at prevailing market prices which vary slightly, depending upon its density, color, flavor, and appearance, the best grades of sirup com-

manding the highest prevailing price. The price, which is governed largely by the prevailing market prices for sugar, varies greatly from year to year, depending upon the total production of sirup and upon the world supply of sugar and economic conditions. Thus, the market price of sirup in barrels at Cairo, Ga., ranged from 60 to 90 cents per gallon in 1925, from 40 to 60 cents in 1928, and from 20 to 35 cents in 1931–32. The very low prices for sugar in 1931–32 were largely responsible for the low prices of sirup in those years and an improvement in the price of sugar should result in an increase in the prices for sirup. When sirup is packed in cans the price is usually 10 to 15 cents a gallon more than when sold in barrels. In localities where the local demand exceeds the supply the sirup producer may usually get a higher price than the prevailing general open market prices, especially if he produces sirup of extra good quality.

Since the income from the cane-sirup industry is confined to the returns from the sale of sirup and cane—either seed cane or cane sold to operators of sirup mills—it is obvious that the cane grower's net profit may be greatly reduced during periods of low prices. Market prices for sirup and cane, which depend largely upon prevailing prices for sugar and supply of and demand for sirup, are governed by conditions beyond the control of the cane grower, but, under any given conditions, the relative return to the grower is governed largely by the efficiency with which he conducts his operations. Therefore, for most successful operation, it is of the greatest importance that the cane grower make every effort to produce maximum yields at minimum cost by growing suitable varieties of cane, by planting adequate quantities of seed cane, by properly fertilizing and cultivating the crop, by securing the greatest possible yield of sirup per ton of cane, and by conducting all operations at the lowest cost consistent with efficient operation.

UTILIZATION OF BY-PRODUCTS

There are three by-products from the cane-sirup industry—(1) the leaves and tops, (2) the bagasse ("pomace" or "mash"), and (3) the skimmings removed when the cane juice is boiled to sirup—all of which are almost completely wasted under present practices. Under present conditions these by-products have practically no sale value, but they are of sufficient value for certain purposes on the farm to justify their use in preference to the ordinary practice of destroying them.

LEAVES AND TOPS

The production of leaves and tops depends upon the varieties of cane grown and the yield of cane per acre. In fresh condition, as removed from the cane at harvesting, production varies from about 4 to 8 tons per acre throughout the areas in which cane is grown for sirup production. To a small extent stock is pastured upon this material, but it soon becomes weathered and unfit for feed and is usually permitted to remain in the field until early in the spring and then burned. In some instances it is placed upon the stubble rows for the purpose of protecting the cane stubble during the winter and is raked off in the spring and burned. The feeding value

of the tops and leaves, while apparently inferior to that of hay, corn fodder, and other winter forage, is sufficiently high to render the material suitable for winter forage provided that it is cured before it has been injured by frost, and that it is supplemented by other feeds. However, weather conditions during the cane-harvesting period are generally unfavorable for curing the tops. Attempts have been made to dry the tops and leaves artificially and to utilize the dried material either for feeding direct or as an ingredient in mixed stock feeds, but the practice has not been established to any important extent. Experiments carried on during 2 years at the United States Sugar Plant Field Laboratory at Cairo, Ga., indicated that the tops and leaves are suitable for making silage of satisfactory quality. Cattle ate the silage readily and thrived on it. Chemical analyses showed that its nutritive value was but little inferior to that of silage from corn. The results of these experiments have been substantiated by results of similar experiments carried on elsewhere, though some investigators have noted that the palatability of silage from cane tops and leaves is inferior to silage from corn, soybeans, and cowpeas. In making silage from tops and leaves it is important that the material be siloed before it has been injured by frost, and that it be thoroughly packed when the silo is filled. When the tops and leaves are not used for feed, plowing them into the soil appears preferably to the wasteful practice of burning them. (See p. 17.)

BAGASSE

Bagasse (or "pomace"), that portion of the cane remaining after the juice has been extracted, accumulates in great heaps at the sirup mills, and at the average small mill it is burned or hauled off to swamps or other waste land. A preferable practice is to permit it to rot for 1 or 2 years, and then spread it over the land and turn it under as a means of improving the humus content, moisture-holding capacity, and texture of the soil. Numerous cane growers use considerable quantities of bagasse as a litter in barnyards and corrals. When used in this manner, it absorbs much of the animal manure which would otherwise drain away and be lost. Where bagasse is used in this manner, the resulting manure should be rotted thoroughly before it is applied to the soil.

Bagasse produced at sugar factories and at large-scale sirup factories equipped with mills capable of obtaining a high extraction of juice has a high fuel value and is extensively used as fuel for the boilers, many sugar factories burning little else. Bagasse produced at small sirup mills is rarely used for fuel as it is ordinarily too wet to burn freely unless it is dried and for the further reason that the cost of the special type furnaces and stokers required for securing best results is usually too great to justify their installation.

Fresh bagasse from small mills may be used as rough forage, stock eating it readily, but it soon sours and becomes unfit for feed. Considerable quantities of the bagasse produced at sugar factories in Louisiana are used in the manufacture of fiber board, or lumber substitute, and small quantities are sometimes dried and sifted and the pith portion used as an ingredient in mixed feeds. It is not feasible to use bagasse from small sirup mills for such purposes, as the quantities produced are comparatively small and the cost of

assembling it at central locations would be prohibitive. The best method of utilizing bagasse from small-scale sirup mills appears to be as a litter in barnyards or by permitting the piles of bagasse to rot and then plowing it into the soil, especially on very sandy soils, on heavy soils, or on soils that are inclined to wash.

SKIMMINGS

The skimmings produced at most sirup mills are discarded. Some sirup makers collect this material in barrels or tanks provided with a tap hole or a faucet about 2 inches from the bottom, permit it to settle overnight or for half a day, draw off the juice between the sediment and the floating scum, and boil it back into the sirup. This practice is of doubtful value, as the quantity of juice recovered is small, and it is very liable to become sour before it is drawn off. The likelihood of its souring may be reduced by thoroughly cleaning the vessels each time they are used, preferably with live steam or boiling water, but even under such conditions it is liable to quickly sour or become slimy or "ropy." If juice in this condition is boiled back into the sirup, the flavor and quality of the sirup is injured.

Skimmings are suitable for feeding to hogs, some sirup makers using all of the fresh material in this manner. The material may also be boiled down to a very thick, semisolid mass, in which condition it will keep for a considerable length of time, and may be fed in small quantities to hogs or stock. It is relished by cattle and apparently has considerable food value. When fed it should preferably be spread over or mixed with other feed.

RECAPITULATION OF IMPORTANT POINTS

Adjustment of the sugarcane sirup industry to meet the emergency caused by the introduction and spread of mosaic, a virus disease of the sugarcane plant, has taken place during the two decades just past. This disease was responsible for losses to the sugar and sirup industries amounting to over $100,000,000. This circular describes mosaic-resistant varieties of sugarcane imported or bred by the Department of Agriculture, which have restored yields of sirup per acre to former levels or higher. These varieties have been adopted in commercial culture to the extent of approximately 90 percent in acreage of sugarcane grown for sirup production and 100 percent in the case of sugarcane grown for sugar production, representing in the latter case 294,000 acres in 1938. Because of desirable qualities other than resistance to disease and consequent larger yields, the new varieties have brought about additional economies in the production of sirup. The seed-cane requirement, which represents a large element in the cost of production, has been cut in half. Furthermore, the ratoon (stubble) crops do not fall off in yield as sharply as in the case of the susceptible varieties formerly grown, and therefore the expensive operation of replanting is required less frequently. Departures from previous practices with the old varieties in planting, culture, harvesting, and rotations with the resistant varieties are discussed.

U. S. GOVERNMENT PRINTING OFFICE: 1940

ORGANIZATION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE WHEN THIS PUBLICATION WAS LAST PRINTED

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