that the cane lodges easily and gives a tangled mass of stalks instead of erect rows. Compared with other soils, heat radiation from the black peat is rapid, and during cold, clear nights in winter this results in lower temperatures and greater injury to the cane. In Georgia it is commonly reported that rich, dark soils along the edges of swamps, while producing high yields of cane, exert a deleterious effect upon the color, clearness, and flavor of sirup made therefrom. Such soils are not generally used, the growers preferring the lighter-colored loamy upland soils.

DRAINAGE

In low, flat areas where natural drainage does not keep the ground-water level 3 feet or more below the surface, it is essential that artificial drainage be provided. Under such conditions, drainage is ordinarily accomplished by means of systems of ditches, the depth of which is sufficient to maintain the ground-water level at least 3 feet below the surface and the width and distribution of which is sufficient to permit prompt run-off of excessive rainfall. In the case of some peat soils the growth of the cane appears to be favored by maintaining the ground-water level at less than 3 feet below the surface, especially during periods of insufficient rainfall, and in some instances drainage ditches are laid out in such manner as to permit raising the water level by flooding them. The low, flat character of lands in Louisiana and southern Florida and the frequently excessive rainfall which occurs in these areas necessitate extensive systems of drainage ditches of ample capacity. The character and the elevation of the lands used throughout the greater part of the areas in which sugarcane is grown for the production of sirup only does not necessitate artificial drainage, though in many instances, such as lands adjacent to the coast and low-lying, poorly drained lands elsewhere, drainage must be provided either by systems of ditches or by tiling.

Irrigation of sugarcane is rarely practiced in the United States, as the amount and distribution of rainfall in the States in which sugarcane is grown is usually sufficient for reasonably satisfactory growth of the crop. However, serious droughts occur from time to time, the effect of which is very harmful upon the growth and yield of the crop. The application of irrigation water would undoubtedly prove profitable in areas of frequent droughts, provided adequate supplies of water were readily available and the cost of applying water would not greatly increase the per-acre cost of producing the crop. Application of irrigation water would be necessary, of course, in connection with any attempts to grow cane in regions with scanty rainfall, such as southern Arizona and California.

MANURIAL REQUIREMENTS

COMMERCIAL FERTILIZERS

The use of commercial fertilizers in sugarcane growing is almost universal in the United States and in other cane-growing countries, but local practices differ widely as to the particular fertilizer elements used and the forms and proportions in which they are applied.

Some form of nitrogenous fertilizer can be applied with profit or is absolutely essential in practically all localities. The quantity of

nitrogen that is applied on the best-managed farms of the South usually ranges from 20 to 50 pounds per acre.

The soils of nearly all sugarcane localities respond to the application of phosphoric acid, but the quantity required varies considerably. From 40 to 80 pounds per acre of soluble phosphoric acid in a complete mixture are usually recommended in Louisiana. To the lighter soils of Georgia and Florida it is not unusual to apply considerably more, even up to 120 pounds per acre.

Applications of potash give little or no response in most of the rich alluvial sugarcane soils of the Mississippi Delta. In the States east of Louisiana, however, potash is applied, usually at the rate of 30 to 50 pounds per acre.

It is a common practice to buy fertilizers ready mixed, though in the interests of economy many farmers do their own mixing. In the trade the mixed fertilizers are commonly described by three figures in regular sequence referring to the percentages of plant food which they contain, and the order, nitrogen-phosphoric acid-potash, is standard practice. However, in the Southern States the order phosphoric acid-nitrogen-potash is commonly used.

The mixtures most popular in southern Georgia and northern Florida for spring and early summer application usually do not vary far from the 4–8–4 formula, i.e., 4 percent of nitrogen, 8 percent of phosphoric acid, and 4 percent of potash. The total quantity of fertilizer applied varies from 500 to 1,500 pounds per acre, depending upon its composition, the fertility of the soil, and the character of the crop preceding the cane. Under some conditions the application of from 500 to 800 pounds proves sufficient, though under most conditions and for most soils more satisfactory growth and yields result from the application of from 1,000 to 1,500 pounds. These quantities are mentioned as an example of common practice in southern Georgia and northern Florida and not as a recommendation for any wide range of localities or soils. Where the soil has been restored to high fertility by turning under a crop of legumes, application to the plant-cane crop of commercial fertilizers, especially nitrogenous ones, may be decreased greatly or even omitted, although in the case of soils deficient in phosphoric acid and potash moderate quantities of these plant foods should be applied. Succeeding ratoon crops should be given sufficient fertilizer to insure rapid and satisfactory growth.

APPLICATION OF FERTILIZERS

In spring planting it is customary to scatter a rather liberal application of mixed fertilizer in the furrows in which the cane is to be dropped. Some implement is run through the furrow to mix this fertilizer with the soil. For cane planted in the fall or early winter, fertilizer is used very sparingly, if at all, at the time of planting, most of it being applied in the spring when the crop starts to grow.

In case of either spring or fall planting, another application is frequently made near the middle of May, designated as a side application, because it is distributed along the sides of the rows and cultivated into the soil. Some growers favor the application of a top dressing of readily available nitrogen at the time of laying-by the crop, July 15 to August 1, but the once common practice of late

summer application of nitrogenous fertilizer has been practically discontinued among farmers who grow cane for sirup, as it is well known that it is very liable to exert a harmful effect upon the quality of the sirup.

In the absence of trustworthy information concerning the fertilizer requirements of soil on which sugarcane is to be grown, the grower should not blindly follow any special fertilizer formulas or rates of application that may have been found suitable for some other type of soil or some other crop, but preferably should carry on experimental trials with several fertilizer combinations which he has reason to believe may prove most suitable. Commercial mixtures carrying varying proportions of fertilizer ingredients or home-mixed fertilizer made from suitable proportions of nitrogen from such sources as ammonium sulphate, calcium nitrate, cyanamid, nitrate of soda and calurea, and sulphate of potash, superphosphate, or other compounds may be used. Materials such as cottonseed meal, tankage, and fish scrap, the decomposition of which tends to increase the humus content of the soil, may also be used for supplying a portion of the nitrogen requirements, though under ordinary conditions these materials are not suitable for furnishing the entire nitrogen requirement, as sugarcane needs considerable quantities of nitrogen in more quickly available form. Cottonseed meal, which is said to exert a favorable influence upon the quality of the sirup, is favored by many sugarcane growers. It may be obtained with a total nitrogen content equivalent to 7 or 8 percent ammonia (NH_3) and is commonly applied at the rate of from 250 to 500 pounds per acre.

ORGANIC MANURES

The value of green-manure crops for restoring or improving the fertility of soil has been amply demonstrated, and the cane grower should utilize them whenever it is possible to do so without interfering too seriously with the crop rotation. Practically all soils in the sugarcane-growing areas, both the heavy clay soils similar to those occurring extensively in Louisiana and the lighter ones occurring in the States farther east, are very responsive to improvements resulting from plowing under such crops.

Plowing under legume crops, such as cowpeas, soybeans, Austrian winter peas, vetches, sour clover, and Crotalarias, early enough to permit the green material to become well rotted before sugarcane is planted usually results in a profitable increase in yield of cane. Crops of this kind, which increase the nitrogen content of the soil, restore vegetable matter and humus, and aid cultivation by improving the texture of the soil, are beneficial even when harvested for hay, but maximum results are obtained when the entire crop is turned under. The cane grower should, of course, utilize legume crops that are most suitable for culture in his own locality. Such plants when grown as winter cover crops conserve soil moisture and retard or prevent erosion or washing. Legume crops are frequently grown between the rows of stubble cane; when this practice is followed the cover crop should be disked in or plowed under early in the spring before the cane has made much growth.

It is the common experience of cane-sirup makers that applications of barnyard manure, especially horse manure, to the cane crop injure

the quality of the resulting sirup, making it darker in color and imparting a strong salty flavor. It is therefore advisable to make the applications to the cane crop sparingly if the cane is to be used for sirup production, or else, if such manures are available, to make heavy applications to the crop preceding the sugarcane in the rotation. The use of liberal quantities of sugarcane bagasse—frequently called "pomace" in Georgia and other States—as litter in the stables and corrals tends to increase the quantity of manure available through preventing waste of animal manure. When bagasse is used in this manner the manure should be protected from the weather and permitted to rot thoroughly before it is applied.

The trash remaining after the cane is harvested is usually burned, but turning it under returns nitrogen, vegetable matter, and humus to the soil and improves its texture and moisture-retaining capacity. Results are inferior to the effect of turning under a green-manure crop, but in light soils especially it is advantageous to utilize trash when feasible to do so without interfering with proper treatment of the ratoons. The total nitrogen in the trash from 1 acre of cane varies from about 10 to about 20 pounds; this is lost when the trash is burned, but, when it is turned under, most of the nitrogen becomes available after the trash decomposes. The slow rate at which trash usually decomposes may exert a temporary deleterious effect upon the growth of the stubble crops, but decomposition may be hastened and the deleterious effect avoided by dusting it with nitrogenous fertilizer, at the rate of 10 to 20 pounds of nitrogen per acre, when it is plowed under. Burning the trash is not only valueless in reducing injury from insect pests, but, as will be described later, results in destruction of certain beneficial insects.

Many who apply barnyard manure prefer to put it into the furrows in moderate quantity in well-rotted condition at the time of planting the cane. It is usually more convenient, however, to distribute it broadcast either before or after breaking the land; in the latter case it is disked in before opening the furrows to plant the cane. The application of 5 to 10 tons per acre, which is the quantity ordinarily applied, permits of a reduction of one half or more in the quantities of commercial fertilizer needed for the crop.

CROP ROTATION

Fertilizer requirements for the sugarcane crop depend to a considerable extent upon the crops preceding cane, and land upon which cane has been grown should preferably be planted for several seasons with other crops before it is again returned to cane. Lands on large plantations in Louisiana are frequently planted to cane again after a single intervening crop of legumes has been plowed under and permitted to rot thoroughly, but in general, and especially throughout the areas in which cane is grown for sirup production, it is a better practice to grow several intervening crops.

Rotation crops may include corn, oats, peanuts, potatoes, cotton, or other crops commonly grown in the Southern States, but it is better to include at least one legume crop such as those mentioned on page 16. The legume should preferably be grown during the season immediately preceding the cane crop and, when feasible, the entire

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crop should be plowed under and permitted to rot before the cane is planted. This practice not only favors the growth and yield of cane, but ordinarily permits of a reduction in the quantities of fertilizer, in particular nitrogen fertilizers, needed for satisfactory growth of the cane.

The universal use of corn for forage and for food in the Southern States renders it almost unavoidable in the rotation program. However, its culture on sugarcane plantations has been questioned because of its susceptibility to attack by mosaic of sugarcane, and because it affords a favorite breeding place for the sugarcane moth stalk borer. (See p. 40.) There appears to be no reason why corn should not be grown in areas in which varieties of sugarcane resistant to mosaic are grown, and in which the sugarcane borer is not prevalent.

FIGURE 3.—A well-cultivated field of young sugarcane in Georgia. In this instance the cane rows have been spaced somewhat wider apart than usual and potatoes, which will be ready to harvest by the time the cane shades the ground, have been planted in the middles.

Farmers who grow only small patches of cane can usually select land that is especially fertile or that has had especially favorable treatment. For small patches it is a favorite practice to shift the cow-pen area from time to time and to use the old area for the production of cane. Good results are also obtained by heavily manuring fields on which sweetpotatoes are to be grown and planting the field to cane the succeeding year.

In some instances the cane rows are spaced relatively wide apart, and an early-maturing crop, such as potatoes, that will mature before the cane shades the rows, is planted in the middles (fig. 3). When this practice is followed, additional fertilizer should be applied in sufficient quantities to take care of the needs of the extra crop.

PREPARATION OF THE LAND

Preparation of cane land varies considerably in different localities depending upon the character of the soil and corresponds in general to the practices followed with other crops. It is desirable to

plow the land considerably in advance of planting time and then to cultivate it thoroughly before planting by means of disks or other suitable implements. Where a green-manure crop has been plowed under the vegetable matter should be permitted to rot completely before the land is plowed and cultivated. When cane is grown on clay soil with a compact subsoil, it is especially responsive to deep plowing, which brings a considerable depth of soil into cultivation and opens the land for the storage of moisture. A reasonable depth to plow is 8 or 10 inches, with a subsoiler run through the furrow to a depth of another 6 or 8 inches. Deep cultivation is especially advantageous in clay-soil areas in which periods of drought are liable to occur. However, deep plowing may prove disadvantageous in the case of cane land underlain by clay or sandy subsoil that is deficient in humus or vegetable matter, and it is not advisable to turn up more than an inch of such raw soil at one plowing. It is preferable to attain the desired greater depth of cultivated soil gradually

FIGURE 4.—Sugarcane field in which the rows follow the contour of the hillsides. When rows are laid out in this manner washing away of fertile topsoil by heavy rains is greatly reduced.

through a series of years, giving opportunity meanwhile for the subsoil that is turned up to become converted into productive loam through mixture with surface soil and vegetable matter.

TERRACING

On the rolling uplands of southern Georgia and adjacent States special precautions against soil erosion are needed. Besides terracing the land on the hill slopes, the rows are usually run on contour lines or so as to give them a fall of only 4 to 6 inches per 100 feet (fig. 4). If the field is terraced, these terraces afford the necessary guide lines. If it is not terraced, it is most advantageous to run guide lines every 3 to 5 feet of vertical rise in advance of laying off the rows. This is done most conveniently and satisfactorily by means of a small farm level and leveling pole, locating points along the hillside nearly on a level, allowing for the required fall, and then, by the use of a 1-horse marker, connecting these points with a light furrow.

FURROWING

After determining the correct course and spacing for the rows, the furrows are opened with a 2-horse middle breaker or other plow. On light, well-drained lands in Georgia and other States flat furrowing is the usual practice, but on heavy poorly drained lands, such as those occurring in southern Louisiana, the furrows in which the cane is planted are ordinarily made in ridges that are elevated slightly above the surface of the field. Ridging is done for the purpose of securing better drainage, the elevation of the ridges depending upon the location and character of the land and the experience of the grower.

The space between the rows varies from about 4 to 6 feet. In the rich soils of Louisiana the usual spacing is 5½ to 6 feet. In southern Georgia 4½ feet is most common. The more rapidly the cane grows and the longer the growing season, the wider may be the spacing. It is desired that by midsummer, at laying-by time, the crop shall shade the ground well.

Commercial fertilizer, and sometimes also barnyard manure, that is applied at the time of planting is distributed in the furrow and mixed with the soil by cultivating with a suitable implement. Seed cane is then distributed in the furrow and lightly covered with soil (fig. 5).

PLANTING

Throughout the States in which sugarcane is grown for sirup production planting has customarily been done in the spring—February or March—but varieties, such as C.P. 29/116, Co. 290, and C.P. 807, have given satisfactory results when planted in the fall. Except in the more northern limits of the cane-growing sections, the practice of planting in the fall appears to be increasing among farmers who have abandoned the culture of the varieties that were formerly grown. In those sections of Louisiana in which cane is grown for the production of sugar the greater part of the crop is now planted in the fall—October and November—though spring planting is still followed to some extent. Elsewhere in the State planting is done either in the fall or in the spring, with an increasing tendency toward fall-planting practice. In extreme southern Florida it is customarily planted in the late fall or early winter, though it is frequently planted in the spring and even during the winter. Different varieties respond differently to fall planting, depending on vigor and rate

FIGURE 5.—Planting sugarcane in Georgia. The cane has been stripped and cut into 2- or 3-foot lengths and is being placed in the furrows so as to form a continuous line of sound cane. The quantity of seed cane placed in the furrows varies, depending upon variety and condition. With varieties recommended in this circular considerably less seed cane is required than with the old varieties.

FIGURE 6.—Stripping the cane for spring planting. In the fall the cane for planting is banked and covered with earth. In the spring it is "stripped" and cut into proper lengths for planting. Spoiled stalks and portions of stalks infected with red rot should be discarded.

of development, and the exact date should vary accordingly, but, in general, the cane should be planted far enough in advance of frost to permit the establishing of roots and some growth before the young cane is killed back by cold weather. The grower who contemplates fall planting should determine by experimental trials the most favorable date at which the cane should be planted in his locality. The advantage of fall planting is that in those areas in which the practice is feasible the cane starts to grow at an earlier date in the spring, and, in the absence of late killing frosts, is more mature by harvesting time.

The depth to which the seed cane is covered with soil is an important factor in connection with germination, early growth, and stand of cane, and, in general, it should be covered only deep enough to conserve soil moisture and prevent injury from freezing temperatures. Seed cane which is covered too deep—5 to 8 inches—fre-