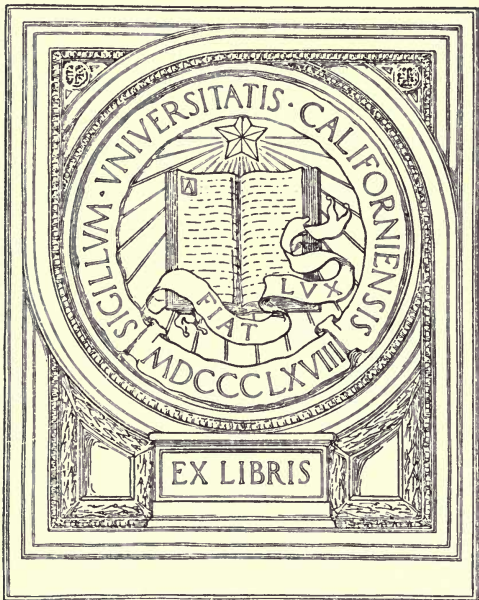


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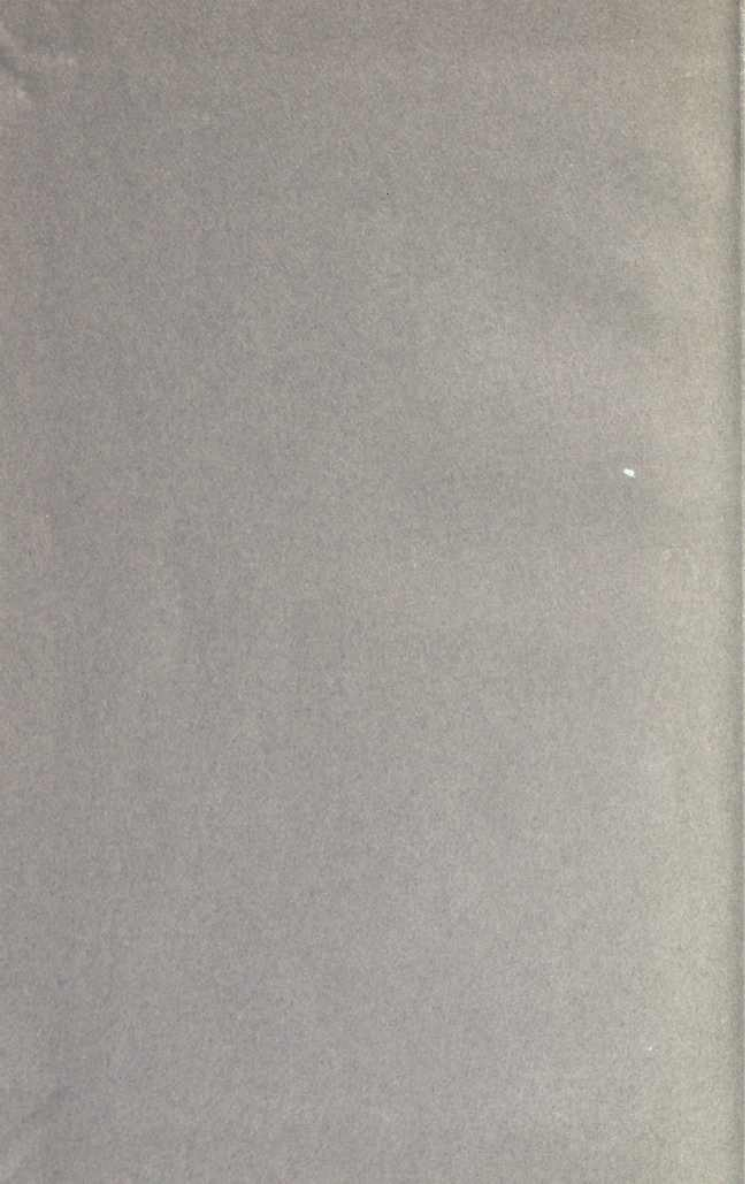


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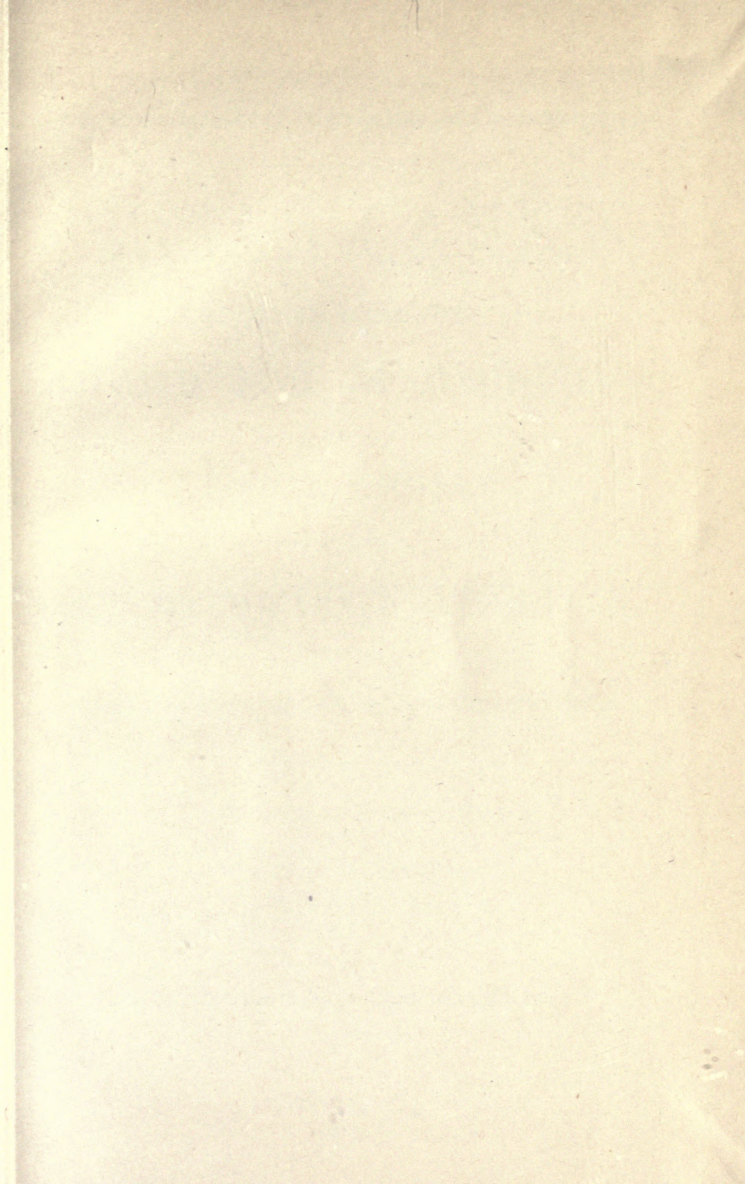


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# SUGAR CANES

AND THEIR PRODUCTS

Culture and Manufacture,

—BY—

ISAAC A. HEDGES,

AUTHOR OF

“SORGO, the NORTHERN SUGAR PLANT,”

—AND—

*President of Mississippi Valley Cane Growers' Ass'n.*

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WITH AN INTRODUCTION ON SUGAR,

BY

GEORGE C. W. BELCHER,

of St. Louis, Mo.

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Published by the Author.

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# INTRODUCTION.

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It is to be regretted that the chemistry of the sugars is still in an unsettled condition. The expenditure of much sincere work has not sufficed to clear away the clouds. When we pour sulphuric acid upon carbonate of lime, we know exactly what is the result of the chemical changes which take place. But when we boil a solution of cane-sugar with free sulphuric acid there is formed a mixture of two organic substances one of which though often introduced to us is yet a comparative stranger. Both cane-sugar and grape-sugar admit of accurate study and the determination of their properties, but what shall we say of *fructose*, or (as we learned to call it) *levulose*, or (as we now hear it called) *chylariose*? What shall we say of the many gums and semi-sugars which are present in all cane-juices and which vary with the climate and the zone? Some of these polarize and others do not; none crystallize, but all hinder the filtration and crystallization of the cane-sugar commingled with them. For none is there any simple quantitative test; many can barely be distinguished qualitatively; still others are, to all intents, unknown substances.

It is the misfortune of organic analysis that its hands are often thus tied. Not only are organic substances extremely delicate in constitution, but ultimate analysis, so useful in organic chemistry, is here sometimes completely at fault. It is useless to demonstrate

that a substance is composed of a certain amount of oxygen, a certain amount of hydrogen, and a certain amount of carbon, when there may be three different substances of the same composition, and the one under investigation may be a mixture of two or more of these. A great deal is expected of sugar chemists that they are really unable to go. After all known tests for the value of raw sugars have been exhausted, there still remains an important percentage of undetermined matter which will turn the scale for or against the profitable working of the sugar.

The corrections of the polarization test are not sufficient to fix the amount of cane sugar present. And just here there is a very prevalent fallacy, namely, that sugars polarizing the same are of equal value. This is an error and has given rise to much misunderstanding. *Raw sugars cannot be compared simply upon a basis of polarization, except when produced in the same country and by similar methods of manufacture.* A muscovado sugar and a molasses sugar, both produced in Cuba and polarizing the same, are of very different value. Of still greater difference in value are sugars from Cuba and Louisiana, though they may polarize the same to a tenth of a degree. In other words, there are unknown substances yet beyond our grasp, which vary with the climate and the soil and affect the polarization test of raw sugars

Yet we do not wish to discredit the polariscope, nor the optical test of sugar. It is a long step into the darkness, even if it does not take us all the way through. It is encouraging to note that the use of this instrument is extending. No refiner can be without it for a day. We would not hesitate to recommend it as an economical investment for a planter of a few hundred acres. We only caution some persons against expecting absolute answers to their questions where, from the nature of the subject, only approximate ones can be given.

There is a large field open to the planter in the use of the polariscope. To study the growth of the cane from day to day, and the formation of cane-sugar in the juice, noting carefully the conditions of the soil, all fluctuations of the weather, and any abnormal or accidental influences. Such an opportunity well improved might enrich the chemistry of sugar in a marked degree. Other methods of



analysis would be available, especially (on clear days) Fehling's copper test. We are not aware that anything systematic and thorough in this line has ever been done, and if not it is a surprising omission. The optical test is so speedy and simple as to peculiarly fit it for such work; and the polariscope is now in such common use that there is no reason why we should not know exactly when the formation of cane-sugar in the juice begins, how rapidly it increases, when it is completed, and what causes affect the operation, either favorably or not. Careful and accurate observation is the foundation of all knowledge. And although we may never be able to put together carbon, hydrogen, and oxygen so as to form cane-sugar; although we may never do more than save from decomposition the sugar which nature has already formed for us; still we can by patient study learn more and more of the mysterious processes by which the components of air and water are changed in the cane-stalk into crystal sweetness.

(We must apologize here for an unavoidable confusion of terms. In order not to use the word *sucrose* which is strange to most readers, we have used *cane sugar*. not merely in its chemical sense as distinguished from glucose (grape-sugar), but also in its ordinary signification, i. e., the product (raw or refined) of the sugar-cane as distinguished from the product of the beet. We trust that the context will make all passages clear)

#### CANE-SUGAR.

The idea has somewhat obtained of late that the production of sugar from the cane is falling off and that this result is in a measure due to the large extension of the sugar beet. This is erroneous. Undoubtedly the sugar production of some cane-growing countries has long been at a stand still while in others it has perceptibly decreased, but many causes have conspired to produce this result.

In the first place, the fertility of the soil and the mildness of the climate both tend to relax the energy of the planters and thus retard progress. Secondly, the presence of slave-labor discourages the use of machinery and the efforts of inventors. Why should machinery be devised to save labor, when labor costs nothing? Why should so much trouble be taken to get a small gain in the

yield of the crop, when, excepting disastrous and unforeseen weather, the planter is assured of pecuniary profit without departing from time-honored means and methods?

Lastly, beet-growing countries are still barricaded by a protective tariff. The ultimate benefits to them of this condition are questioned by many, but as to its immediate effects there can be no doubt; indeed, the beet industry of Europe is a rock on which a protectionist can stand a long time quite safely. The whole subject of tariff is so constantly under discussion and is so tempting to argument, that we shall omit anything beyond a mere mention of the situation. To consider the cane-growing countries overmatched by protective legislation is to disregard the fact that from its very inception the manufacture of beet sugar has been fostered with great care, and diligently studied in every point and with all the light that science could cast upon it. A similar course in cane-growing countries would have astonished the planters by its results and a few shining examples of recent progress afford sufficient proof.

The cane-sugar production of this world can be estimated at about 2,150 000 tons. Accurate figures are difficult to obtain owing to the absence of official statistics in most countries. The total is probably about the same as two years ago. Of this amount Cuba produces nearly one-third. No other single country produces over 200,000 tons. Any disaster to the Cuba crop consequently affects the market to a large extent. Of late years the influence of the crops in more distant countries such as Brazil, Java, and the Philippine Islands, is sooner felt than formerly, owing to the extension of commercial relations.

We have just alluded to some cases of unusual development. In a majority of these we notice the direct influence of English skill disseminated by commerce through distant parts of the world. The most rapid growth of importance has occurred in Egypt where the production now exceeds 40,000 tons. The exports increased from 1866 to 1875 over 800 per cent. The Khedive, among his numerous extravagancies, has been in no wise backward in sugar manufacture and the result is the introduction of the best machinery with skilled labor to work it. This will be a better legacy for the Egyptian nation than many others he will leave. British

Guiana, or Demerara, is probably the furthest advanced of cane-growing countries. Vacuum pans have been in use here for upwards of thirty years, and are now the rule, not the exception. Demerara sugars have always ranked high in popular esteem, and a large proportion goes into direct consumption. It was the highest and low-colored centrifugal sugars from this colony that lately gave rise to legal action in the United States. In Queensland the culture of the sugar-cane is extending very rapidly. Not only are the soil and climate favorable, but the planters and refiners have hastened to avail themselves of the most approved methods of working. Peru shows a constant increase in the production which is now estimated at over 70,000 tons. Most of the Peruvian crop is imported by England; and in this country, as well as in Egypt, Demerara, Queensland and many others, English science and English machinery have in a great measure turned the wheel of progress.

There are some countries where special causes have operated to increase the production. The Philippine Islands have been benefited by a growing demand for low grade sugars for refining purposes, particularly in the United States. The product of those islands has been lately estimated at 130,000 tons, but the manufacture is crude and there is consequently a fine opportunity for still further advances. The Sandwich Islands are just now in rather a unique position owing to the effects of the reciprocity treaty with the United States, whereby all sugar produced in these Islands is admitted to the United States free of duty. Of course, such a bonus as this is very certain to stimulate the efforts of the planters, as it insures a very handsome margin for profit. The production was estimated at over 12,000 tons in 1874. Later figures show a large increase.

It is interesting to note the gradual adoption of sulphur processes in different cane-growing countries. Though varied in name and and in details, they are more or less the same in the general principle. This is the substitution of sulphurous acid in an organic salt of an inorganic base, thus setting free the organic acid, which is volatilized and driven off. This reaction is usually accompanied by some improvement in color. That sulphurous acid also

defecates gummy solutions, must be believed from the weight of testimony in its favor. Indeed the utility of this re-agent in the manufacture of raw sugar from cane-juice would seem to be fully demonstrated. Yet, singularly enough, the benefits of its employment in the refining of cane-sugar are at least doubtful. Some experiments have apparently given good results, and others have been indifferent or disappointing. It is not, however, injurious in any way, and the most that is claimed against it is that it is superfluous.

Prominent among countries adopting the use of this agent in some form are,—British Guiana, where the use of bi-sulphite of lime has long been in vogue; Egypt, where factories have been built, specially planned for the use of sulphurous acid; Porto Rico, where it has been long and successfully used; Jamaica, St. Croix, and many others, where it is being introduced and favorably received; Mauritius, where is being largely adopted what is known as the "Icery Process" an application of the monosulphite of lime; and (most familiar to all our readers) Louisiana, where the use of sulphurous acid, or of bisulphite of lime is so general as to seem almost a necessary feature of sugar manufacture. Efforts have been made to adopt the Diffusion Process, so popular in European factories, to the needs of the sugar-cane planters, but so far success has been doubtful. It was tried in Louisiana. It is now being worked in Madras, where great success is claimed and an increased yield of 20 per cent. Unless carefully managed, this process is apt to enlarge the cost of evaporation very materially.

#### BEET-SUGAR.

The culture the of sugar-beet has steadily increased until now it may be considered a permanent part of the agriculture of three-fourths of Europe. From France to Russia, from Italy to Sweden this industry has spread. In the central portions of the continent it is of the greatest national importance. As such it is regarded, and although in some countries heavily taxed, it is amply protected against the competition of cane-products. The circumstances which favor it are;—a suitable soil, a climate uniform but not too hot, cheap manual labor, and a thrifty and intelligent agricultural pop-



ulation. These conditions are difficult to combine in a newly-settled country, and, not unexpectedly, experiments in beet-culture here have proved failures. The last attempts, in California and Maine, seem to promise better results; and it is certainly reasonable to believe in success somewhere between the two oceans.

In 1860 the beet-sugar production of Europe was estimated at less than 450,000 tons; the present crop (1878-9) will aggregate, according to the latest calculations, 1,497,000 tons. During the same period the cane-sugar production of the world has increased in a much smaller ratio.

One admirable feature of this industry is the abundance of statistics which are accessible to the interested public. Accurate statements of production and consumption in many cane-growing countries are a desideratum.

#### SUGAR REFINING.

Much of the present development of sugar production is due to the energy and skill of the refiners. They have been ever foremost in the introduction of improvements and to them the producers of raw sugars (both cane and beet) continually look for new ideas and inventions. It is to the credit of the sugar refiners that they have kept full pace with the most progressive of manufacturing industries, and that by no trade trickery, but by legitimate methods of working and by persevering enterprise the cost of refining sugar has been reduced 60 per cent. in the last fifteen years. A first class refinery can now put its raw material into marketable shape at a cost of five-eighths of a cent per pound, and this including interest, wear and tear of machinery, etc., etc.

Sugar refining, as now practised, is in its general outlines much simpler than formerly. All superfluous overworking is being fast dispensed with, and the complications that characterized the old mould houses are now well nigh forgotten. On the other hand, the important features are studied more carefully than ever before. Such are,—the proper working of the bags, the management of the char, its washing and revivification, and the disposition of the sweetwaters, etc. Most refineries refer constantly to the polarizing of their liquors and syrups as a guide for working, and not in any

the value of the raw material but that of the refined product is determined in the laboratory.

The one cardinal principle in the refining of cane sugar is to expose the sugar to the influence of heat no longer than is absolutely necessary. The ideal of cold working is, with the present methods of filtration, unattainable, but the disastrous effects of continuous heat, especially in the presence of soluble impurities, must be kept constantly in mind. This is a matter which equally concerns the producer of raw sugar and it is beginning to be appreciated in cane growing countries. A vacuum pan is the cheapest piece of machinery a sugar planter can own, and were all raw sugars boiled *in vacuo*, the production of the world would be wonderfully increased.

It is beyond the scope of this article to refer otherwise than in general terms to the great improvements in all sugar house machinery; especially, the perfection of vacuum pans, with their condensers and air-pumps; the increased capacity and novel construction of the bag-filters and char-cisterns and revivifying kilns; and above all, the number and ingenuity of labor-saving devices. In this latter point, probably no other branch of manufacture will show greater progress in late years than the leading refineries of England and the United States. As a consequence, some establishments have attained a colossal size, and wield a direct and indirect influence upon trade, measured by millions of invested capital and thousands of interested employees.

Marked changes in the character of the refined products may be noted. There is a large decrease in the quantity of molasses that is turned out, it being no longer as remunerative as formerly. This is occasioned by the cheapness and attractiveness of what are known as corn-syrups, which are mixtures of dextro-glucose with about 20 to 30 per cent. of some low-colored refined or unrefined molasses. The extraordinary quantity of yellow sugars now turned out is another feature. There is fashion in sugars as well as in silks and satins. The snowy loaves that formerly adorned the grocers' windows are gone and the public taste has been educated to the consumption of sugars of the cheapest face-value. This style of goods has been pushed to an extreme, and some revulsion

## INTRODUCTION.

in feeling has already been manifested. There is more than a possibility that refined sugars may yet be sold on a basis of polarization. Such a course could only give satisfaction, for if a man should choose to buy a sugar polarizing 80 and pay what he considered a fair value, it would be the same as if instead of buying an all-woolen shirt, he selected a wool and cotton mixture. The polariscope test for sugars would be simple and expeditious, and the color would still remain an additional consideration.

\* \* \* \* \*

The manufacture of sugar from the beet, and its refining will always differ in many respects from the treatment of cane-products. The almost total absence of "inverted sugar" permits an alkaline working, and this in its turn the use of heat to an extent unknown in factories which handle the latter class of sugars.

The general features and the machinery employed are very similar, so much so that a refinery proper may be equally adapted for working raw sugars of either class. But the method of defecation by over-liming modifies all following processes, and we see in beet-sugar refineries, hot-boiling and strong crystallization, with the syrups constantly separated and worked down until the residue is an unmanageable mixture of salts, gums, and imprisoned cane-sugar, fit only for the distiller's use. This is more properly sugar-refining than the methods now in fashion in England and the United States. But it would not pay, except with beet products or very high grades of cane-products. In Europe refined sugars are almost all pure white, and are sold with a strict regard to chemical test; here they are classed and sold by color only. There they buy almost no "inverted sugar" in their raws; here they buy plenty and must sell it in their refines in order to make both ends meet.

As might be expected the working of beet-products continually invites chemical treatment. It is wearisome to study the various processes devised and experimented with in France and Germany. Many of these are for the recovery of cane-sugar from beet-molasses, and are wholly inapplicable to cane-products. Some serve to economize bone-black, and a large number are methods of defecation. One process of considerable importance has been adopted with great success by an English refinery. It is applicable to all raw

sugars containing less than two per cent. of "inverted sugar". It is called by the name of the clarifying agent used—'The Sacrate of the Hydro-carbonate of Lime Process', or by the name of its inventors "The Boivin and L'Oiseau Process". The refinery of Mm Sommer & Co., Paris, has been working this process for years.

#### GLUCOSE.

Before closing it may be well to speak of another industry which has come prominently into notice of late years and which partly from a confusion of ideas regarding the character of its products, and partly from having adopted some of the methods and machinery of sugar-refining, has been more or less associated with it in the popular mind. We refer to the manufacture of glucose and dextro-glucose. The recent increase in the consumption of these articles is enormous. The cost of production has so diminished that for many purposes for which it is equally adapted, cane-sugar is no longer available, being hopelessly undersold.

Although glucose (grape-sugar) was known to the commercial world many years ago, it has only been within the last ten years, that its manufacture has assumed any considerable proportions. The theory of the process is familiar to our readers. It is the conversion of a solution of starch into a solution of glucose by boiling with free sulphuric acid, the acid being removed after the conversion by the addition of a small quantity of lime, an insoluble precipitate of sulphate of lime being formed. This simple operation is the foundation of an industry now taking high rank among others and gathering around it all the accessories consequent upon such position. Flourishing equally well in many parts of the United States, glucose manufacture has developed most largely at Buffalo, N. Y., where the low cost of the grain and the extended shipping facilities both east and west, have stimulated the energy of the manufacturers.

It is only right that all fair minded persons should deprecate the prejudice that was recently stirred up against the products of the glucose factories. The charges of wholesale poisoning, and of ruining the public health by inducing various forms of abdominal disease, would be ridiculous, were they not malicious in their



tendency. Glucose never did and never will compete with cane-sugar as a sweetener. But as a basis of fermentation it is not only much cheaper, but in some cases otherwise preferable. This is properly its sphere of usefulness. The difference in price between grape-sugar and cane-sugar is so great that were it feasible, there would be temptation to use the former as an adulterant of the latter. But this has probably never been done, and if a method of crystallizing the two together should ever be discovered, the public taste and the market price would soon settle the question. The effect upon the health of the consumer would be same as when coffee is "stretched" with chicory, or claret with water.

#### PRESENT QUESTIONS.

Whatever may be the future of the sugar industry in this country, the refining branch seems destined to remain. Whether beet culture will prove successful on a large scale, whether cane-sugar can be economically extracted from the juices of sorgo and maize are yet to be determined. The production of raw sugars depends upon climatic conditions, peculiarities of the soil, and the economy and energy of the agricultural class of population. But sugar-refining will always thrive in the busy manufacturing districts where nature's reservoirs of coal and water are at hand, and cheap transportation enables the refiner to meet the consumer's wants with ease and safety.

Probably nowhere else in the world has the margin for sugar-refining been figured so closely as in New York, nowhere else has there been displayed so much enterprise and skill. The remarkable growth of this business there in the last fifteen years bears ample testimony to the quality of American brains.

But back of all individual efforts, no matter how skillfully directed, lie causes deeper and more potent. The influences of legislation for good or evil we may yet recognize more clearly than we have ever been called upon to do. Our trans-atlantic cousins can tell us a great deal about sugar legislation, how it works in theory, and in practice. Congress has it in its power, by ill-advised action, to make the refining industry a national monopoly, or to close the doors of every refinery in the country.

There is another point worthy of study. It is what might vulgarly be termed "the path of empire." The development of trade-centers, like centers of population, is determined by definite causes. So far we have seen one sugar-mart grow to the exclusion of others. New Orleans, Baltimore, Philadelphia, and Boston have each enjoyed special advantages, but New York has far outstripped all. Now, it is reasonable to expect one or more additional trade-centers to rise into prominence with the growth of such a large country. If raw-sugars continue to be imported, San Francisco has the most promising future. If domestic cultivation of sugar-yielding plants is destined to supply a fair portion of our wants, no city is better located to secure a leading position than St. Louis. Even her neighbors and rivals in other branches of trade will concede that this conclusion is well founded.

But, turning from what may seem a side-path, the question of the ability of the world to dispose of the increasing product of the cane and beet is one that is often seriously considered and has given rise to much doubt and discussion. The truth is, that the world's consumption of sugar is continually increasing. Local checks occur when prices reach a prohibitory figure, but when prices fall again the lost ground is regained. The consumption in Great Britain per head of population nearly doubled from 1855 to 1875. Other countries show even larger gains. Sugar has long ago disappeared from the class of luxuries and become a staple article. It has been put to an ever-increasing variety of uses; the preserving and canning trade have made the summer months the best market season. In great Britain, when prices are very low, sugar is used in large quantities for brewing, and it is stated that the poorer qualities are used to a considerable extent for feeding stock. It is difficult to say that a limit to consumption has yet been reached. If sugars should be cheapened by any means one third or one half of their cost, new outlets, not now considered or even known, might market a much larger production than the world has ever seen.

If maize and sorgo should, by improved culture, gradual changes in character, or other means, be brought into the rank of sugar-producing plants, something like this must happen. Competition

among farmers would reduce prices to an extent which would evoke new uses and adaptations. The United States might or might not export raw sugar; they certainly would use a great deal more than they do now.

In closing, we would only add that if we have seemed to speak vaguely or distrustfully on any point, it is not because we have prejudices, but because it is sometimes so hard to be sure of a fact, and so easy to pretend to be sure of it. There is nothing more inviting than the study of sugar from its birth in the cane field through all its checkered life. And if anything we have said shall induce an increased interest on the part of any reader, we shall feel amply repaid for our trouble.

ST. LOUIS, APRIL 2, 1879.





# The Northern Sugar-Cane.

## CHAPTER I.

*Embracing Convention Proceedings on this subject.*

The purposes of this work being especially as an instructor, I do not propose to go into the history of these Northern Canes, except so far as to trace those now most in use as preferable for general cultivation, and for that purpose I shall here introduce my paper, read before the late convention at St. Louis. But to those desiring the more general history, I would recommend the work "Sorghe and Imphee" by *Olcott*.

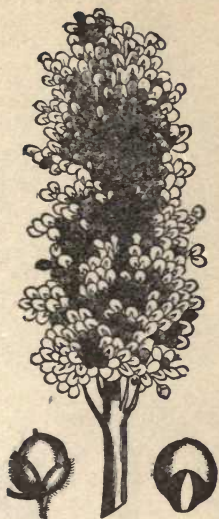
That there are now several new varieties of these canes, as a result of hybrid there can be no doubt. This crossing has resulted, as I predicted sixteen years ago, in an improvement of the canes, new names are being given these crosses, such as Early Amber, which I cheerfully accept as more appropriate than the Zulu Kaffir, names which are difficult to pronounce or spell. I have arrangements made for pushing the subject of improving our varieties still further by hybridizing the most desirable kinds, and selecting the most precocious and best seed heads. The facilities we have for changing seeds from North to South and

*vice versa* is quite fortunate. There is probably no other crop cultivated that is so materially and favorably affected by change of latitude as these canes, although the cost of seed is increased some, yet it is insignificant when compared with most other field crops, as two pounds will plant one acre, which can now be had by mail for \$1.00, while to plant southern cane it will cost at least \$30 worth of cane, besides the extra labor of first burying it to protect it from the frost during the winter, and then taking it up and planting again. Hence, if we are unable to obtain as large a yield of sugar per acre, still that which we do get will cost us less for cultivation, and then we obtain an amount of forage and seed for stock feed that will, when rightly handled, pay all the expenses of cultivation and delivery to the mill. This position is fully sustained by the statements of different farmers as hereafter reported in this book. I cannot urge too strongly the necessity of utilizing every portion of this crop in order to make it remunerative.

Why waste the forage of this crop and then have to replace it with its equivalent of some other. In order to handle this forage correctly, calculations and preparation must be made in advance, so that when the season for taking it in hand comes, there will be no detention or neglect, consequent upon a want of readiness. There is, probably, no one feature of the farmer's operations in which he suffers as much as in the deficiencies, from a want of a thorough study of their new engagements, prior to their commencement.

The permanent organization now effected here, if sustained by those so directly interested, will, by their correspondence and annual reports, disseminate information that must result in a great mutual benefit.

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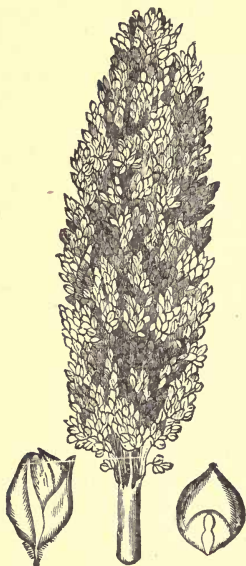
No. 2.



No. 1 tuft is a representative of what appears a crop of the Liberian, one of our most productive canes, with some other, giving a larger stalk than the Early Amber and a seed much like it. It is highly recommended. I shall have it carefully cultivated and tested in order to learn its merits as a sugar-producer. The general contour of the tuft is like the Liberian, but the kernel more like the Early Amber.

No. 2 is another more closely resembling Early Amber, but still the farmer who produced it had the latter also, and says, there is a marked difference. The sample of sugar he sent me is a coarser and harder crystal than any I have yet met with. I am having a barrel or more of the sugar sent me and will swing it and apply the polariscopic test. Should it result satisfactorily I shall endeavor to place enough of this seed in cultivators' hands for future test, and

No. 3.



OOM-SEE-A-NA.



REGULAR CHINESE VARIETY.

report—which with my arrangements in different latitudes will afford satisfactory results. My great desire is, to determine this year, if possible, the best variety for sugar.

No. 3 is a tuft of Oom-see-a-na. Although a good cane it is, like the Chinese, falling out of favor. It, no doubt will do well as a party to hybrid with other early-sweet varieties and thereby obtain a larger product than the Early Amber by itself.

## SEEDS, THEIR VARIETIES AND ORIGIN.—BY I. A. HEDGES.

There are several species of Canes or Plants that possess Cane Sugar, the most prominent of which is that of the tropical, known by the Latin name of *Saccharum Officinarum* or Southern Cane, of which there are several varieties. But the Canes that form the subject for which this convention has been assembled, are commonly called Sorghum, and classified by Linneus as *Holcus Saccharatus*, and have come to us from two widely distant points of the Eastern hemisphere, viz. N. E. Asia and S. E. Africa; each, however, were reproduced in France before reaching us. This is Chinese, a fair specimen, as you will see it has a center spindle, with long foot-stalks standing on all sides around the stalk, bearing large seed covered by a black pellicle.

The stalk grown in good soil will attain an average of about 10 feet, with joints about 10 inches apart, stalk about one inch in diameter, of a deep green color, slightly covered with a whitish wax; matures its seed in about three and one-half months. The principal objection to it is a liability to fall before the wind and make harvesting expensive, while the juices do not possess quite as much cane-sugar. For its introduction into this country we are indebted to our government.

The African varieties were collected by Mr. Leonard Wray, of England, who found them growing extensively among the Kaffirs of S. E. Africa, where he spent some time in experimenting with them in sugar-making, being himself a practical sugar-maker and author. Finding them a genuine cane-sugar producing plant, and maturing in a few months after planting,



he became greatly elated with the prospects before him. He gathered seed from fifteen varieties, each of which had a specific name, but as a whole genus they were called Imphee, which, I presume, is peculiar and belongs to the natives, as I have never met with it elsewhere. The names of the different varieties as given by Mr. Wray, are equally peculiar, as follows; Vim-bis-chu-a-pa, E-a-na-moode, E-enga, Nee-a-za-na, Boom-vwa-na, Oom-see-a-na, Shla-goova, Shla-goone-de, Zim-moo-ma-na, E-booth-la, Boo-ee-an-a, Koom-ban-na, See-en-gla, Zim-ba-za-na and E-thlo-see.

All these varieties Mr. Wray had reproduced in France, where he made sugar from them of a quality similar to those best samples on exhibition here. Mr. Wray having met the late Horace Greeley in France, was persuaded to come with his seed and samples to this country, where he arrived late in May, 1857, with 1,500 pounds of seed in the tuft, most of which was planted by the late Gov. Hammond of South Carolina. but, by an urgent application, assisted by my friend H. Greeley, I obtained enough to plant ten acres of the earliest varieties, which I had planted upon the farm of Brutus J. Clay of Kentucky, June 10th.

Mr. Wray only got his seed into the ground on the 20th of June. The season there was very wet (which is detrimental to a cane crop.) From various causes, not necessary to mention here, Mr. Wray failed to make sugar and abandoned his seed, as also his patent process, and returned to England disgusted and largely out of pocket. Thus much for the history of the only importation of seeds that I have been able to trace back to their nativity.

We see advertised "Otaheitan," which is the name of one of the varieties of a Louisiana cane extensively

cultivated there from planted canes, not seed ; another is the Liberian, some call it club-head. This is of Wray's Imphee, Boom-vwa-na, and has maintained its character very distinctly. I can well recollect seeing it in Mr. Wray's hand and took it for a Sumac tuft myself. It is a hardy and good cane, suited to late working, and will make sugar, as will be shown by farmer Schwarz sample.

Here is a few tufts sent from Meridian, Miss., by Mr. Shannon, who calls it Crook Neck Sorghum which evidently is an Imphee, Nee-a-za-na, as will be seen by the engraving in my book, taken fifteen years since. It has somewhat changed in the color and size of the seed and also the stalk, as described to me by Mr. S. who called on me some weeks since. Whether this change is the result of hybrid or cultivation I cannot tell. Mr. S. is an intelligent gentleman and gives it great favor, as will be seen by his communication.

Another mis-named cane is the Honduras. It is a very late cane, at least thirty days later than the Boom-vwa-na or Liberian, and, although a sweet and good cane, it is of doubtful propriety to plant north of Mason and Dixon's Line ; it is an Imphee, Vim-bis-chua-pa.

I now come to the variety so widely known as the Early Amber. These tufts are a fair specimen of the various lots that have been sent to this convention. As most of them have been packed in small packages they will hardly show their correct figure when growing. They have a very heavy kernel which, when entirely clean, will weigh fifty-eight pounds per bushel, which corresponds exactly with the Nee-a-za-na as well as the size of the kernel, though not quite as white,

This flower is a sample which has been furnished me by Mr. J. S. Tompkins, now of this city, whose communication and samples of syrup from this cane will attract much interest at the proper time. This Amber Cane has the appearance of being an hybrid in which Nee-a-za-na is a party and either the Chinese or one of the Imphees the other, most probable the former, which accounts for the longer foot-stalks and darker seed, while the large kernel and shorter stalk with earlier maturity attaches to the Nee-a-za-na. But whatever is its origin it matters little, or whether it was crossed in France and brought here by Mr. Teas of Indiana, eighteen years ago, it is all the same. We have it and it is a great boon to us, as by its early maturing it not only facilitates sugar-making but affords us a longer season for working, as it will mature during the warm season which will facilitate the process of granulation in the hands of those working it up with a view to sugar-making. There are other samples of seed that have come to hand, but not possessing qualities to recommend them as equal to those already described. One tuft by mail, apparently an hybrid of either Amber or Nee-a-za-na with Liberian, that may prove a good thing, I shall have it carefully cultivated and report next season.

The great object being to determine the best varieties for sugar-making, as also that of syrup, and plant them in such order as to have them ripen in rotation in order to supply the works for as long a period as possible. That there has been an improvement in these canes since first introduced seems evident, and in this we see our hopes being realized.

I will now appeal to this convention not to close its labors without providing in some manner to further,

and more definitely pursue, a course of improving them until we shall have secured for ourselves and posterity a blessing that shall make us free of all foreign or adulterated products, so that we can say (as our honorable friend that produced this pile of sugar) that, if "our land does not flow with milk and honey, it may with sugar and molasses."

I am not aware that any appropriate, systematic efforts have been made to improve the cane by a careful selection of the seed, and it would be strange indeed if a plant like the cane, brought from another country, and cultivated under circumstances so peculiarly unfavorable, should not deteriorate. Even Indian corn and Irish potatoes are not expected to improve, or even preserve their qualities from year to year, without careful attention to the seed, and a system of reproducing from the best samples.

The most important qualities in the cane are saccharine richness, per centage of juice, large stalk, and early maturity; and these qualities should, as far as possible, be all combined. In every field of cane some stalks ripen earlier, some grow to a greater size, some are more juicy, and some richer in sugar than others. It should be the aim of every planter to select from his growing cane the individual stalks which most fully combine these qualities, and set apart the seeds which they yield for the next season's planting. And this process should be pursued from year to year, always producing the richest, the largest, and the earliest stalks.

In some sections of the country the order of preference will differ from others. In the more northern range, where the seasons are short, seed will be selected with more particular reference to early matur-

ity; where the seasons are longer, prominence may be given to size of stalk, volume, and richness of juice.

In selecting seed stalks from the standing cane, the comparative size and time of maturity will be plainly enough indicated to the eye; but with reference to the other qualities, something more is needed, and it is with reference to these that the most indifference or negligence has been manifested. In order to test the cane properly, each stalk previously selected with reference to size and maturity, should be separately weighed, and the juice thoroughly expressed. The juice should then be carefully tested by the saccharometer for richness, and accurately weighed for per centage or comparative volume. By these means all the essential qualities of a good rich cane may be secured, and until they are faithfully employed, complaints about deterioration may be expected.

I have been much surprised at the careless indifference manifested by most farmers in the preservation of their seed. If they were to practice the same slovenish custom with other crops upon their farms, their reputation for agricultural skill and economy would be at a large discount, as well as their financial credit. In my intercourse with them I find but few who even gather their seed for stock-feed; the custom generally being to slash it off, and leave it on the ground to waste, unless, perchance, the field is so circumstanced that hogs or cattle can be turned in. Although this is quite wasteful, nevertheless it is preferable to the entire loss. Mr. Wm. Haddax, near Osborn, Ohio, informs me that his hogs never done better upon any feed than upon the cane stubble, with the seed scattered as above.



## CHAPTER II.

### SOILS AND CULTIVATION.

*Embracing also Mr. Ricker's Essay before the Convention,  
and discussion thereon*

There has generally been a greater mistake in the selection of soil than any other feature of this business, mostly growing out of a desire to obtain a large growth, regardless of the quality of the juices.

It is well known that low wet, deep black, or freshly manured lands are productive of rank acid vegetation, whether of fruits, vegetables, or grapes. Stock will shun the vale and nip close the hillside, because of the greatest amount of saccharine and other nutrition; the multiplied testimony is now so great, when added to that of our thorough cultivator and valued pioneer, Mr. Ricker, that it is to be hoped we shall soon get out of that rut of error.

The alluvial fields of Louisiana are free of ammonia but strongly impregnated with the same properties that make the waters of the Missouri river (out of whose deposits they are chiefly made); among these properties magnesia is quite prominent.

Where the soil does not possess lime it should be added either in the form of quick-lime or the sulphates,

common plaster or plaster-paris. I am well satisfied by a long series of observations, that sugar-making from these northern canes will only be made successful by a thorough system of cultivation, by which to produce a *true sugar-cane*, free from the gums and albuminous properties that require chemical solutions and patent processes to counteract their baleful influences upon chrysalization. We have the satisfaction to know that by far the best sugar, and the only specimen from field operations at our late convention, was that of the Honorable Seth H. Kenny of Minnesota, (whose communication will be found in the chapter on sugar-making); he used no chemicals or reagents whatever, hence his cane was rightly conditioned by cultivation; let me, therefore, again strenuously urge the most rigid adherence and attention to the foregoing suggestions.

I here introduce the valuable essay of the Hon. E. S. Ricker of Locust Corners, Ohio :

#### E. S. RICKER'S ESSAY ON SOIL AND CULTIVATION.

I shall confine my remarks to my own immediate vicinity and the results of my own observation and experience. We have three varieties of soil within the limits of this neighborhood.

First. Ohio river bottom land. Rich for corn, and yields great crops of cane with an abundance of foliage; but the juice is not sweet and syrup not pleasant.

Second. Low lands along our creeks. These bottom lands have often much sand in their composition, and, when so, produce large crops of cane, making fine syrup.

Third. Uplands. My farm is on rolling upland.

originally a deep, virgin soil, with clay subsoil resting on blue limestone. My fields are underdrained with tile from three and a half to four and a half feet under ground. I cultivate crops in rotation; following a cane crop after corn, and the corn after meadow or sod. Thus, in the winter, spread from sixteen to twenty wagon loads of barn-yard manure per acre on the sod, and plow with three horses, nine inches deep. Cut and shock the corn, and expect a yield of seventy-five or more bushels per acre. Let no animals roam over the field to tramp it. and in early spring plow so deep that there will be twelve inches of loose soil. The rotten sod, with the manure, makes the soil mellow as an ash heap, and is the best possible condition that I know how to prepare a field for corn. Now level the field with a drag made of six rails, woven together with two trace chains at about three feet from the ends of the rails. This does not pack the ground as does a roller. Then plant the seed with a drill, dropping about six seeds to the foot, and in rows three and one-half feet apart, the drill doing the work of furrowing, dropping and covering. By the time the seed is well sprouted, go over the field again with the drag; and just about the time the first plants are appearing, drag the rails across the previous dragging. Now we have a fresh, clean, mellow field for the plants to emerge into daylight. As soon as the row of plants can be traced with the eye, with a one-horse plow, with a fender, to keep the dirt from the plants, plow as close to the rows as possible; and one with a steel rake can clear the plants and keep up with the plow. By the time the plants are a finger's length high, scrape the rows with sharp hoes and thin the plants to about three to the foot. If this work is thoroughly done, then go

about three times, twice in a row each time, with a double-shovel or cultivator, to be completed by the time the cane is four feet high, will be sufficient. Thus prepared and cultivated, I expect a yield of from 165 to 185 gallons of refined syrup, of a density of 42 deg. Baume.

The next most successful way to prepare a field for cane, is to let the aftermath of a clover field remain through the fall and winter untouched until about the tenth of May. By that time the young clover will be well up. Then turn under deeply. Subsoiling would be beneficial in most soils, especially where land is not under-drained. So might irrigation be capital, but only the few can command it. Soaking the seed and rolling in plaster may be advantageous if conditions be right at the time of, and after, planting. Otherwise I never tried it but once. An old clay field with all the organic compounds (the nitrogen, oxygen and carbon, etc.,) so nearly worn and washed out that cane will but feebly or barely grow upon it, will yield the clearest and the finest fruity flavored syrup, but the quantity may not pay for cultivation. On the other hand a field in good heart, freely and freshly manured from the hog pens and horse stables, might give an enormous yield of syrup, but of a quality that would be unfit for the table.

#### SOILS, AND SEASONS OF PLANTING.

There has been great remissness under this head. Farmers seem to have thought too little of this crop, and hence seldom make a good selection of soil, or give that attention in its preparation that would insure the best results. There is no plant more feeble or sensitive in its early growth than this; therefore, the

selection of soil, as well as its preparation, should receive especial attention. Where it is possible, I would underdrain, and plow very deep; always preferring a clover lair, if possible, or other newly-broken ground to that of fresh-manured land, as it has been repeatedly shown that the cane will partake of the character of the soil. An instance is reported where sulphur and salt was put upon the ground before planting, and the syrup partook of it quite distinctly. A free use of lime or ashes will be found advantageous, especially upon the lower tables of land. These trials should be made and reported for future guidance. I would recommend planting in a ridge rather than the furrow, as the seed needs the warmth of the sun, and freedom from the cold rains of May, to germinate.

The ground for this crop can not be plowed too deep, as its roots penetrate to a great depth, even as far as three and one-half feet, to which depth I have traced them. As before indicated, I am satisfied that the African cane will stand a much stronger soil than the Chinese.

It would be altogether useless to attempt the naming of any particular date for planting. Seasons differ; and, therefore, I can only say, plant as early as the ground, by being dry and warm, seems fitted for the seed, and then plant shallow—*very* shallow.

The seed should, previous to planting, be soaked in warm water until an appearance of germination is perceived. This, in the Imphee, will require about two days; in the Chinese, nearly six.

It has usually been recommended to plant in rows running north and south; but, from some considerations and facts occurring to me, I am inclined to prefer rows running east and west. The west wind storms



are the most destructive, and a crop planted in rows running in the direction of the winds will, of course, stand much better than one the rows of which are transverse to such a direction. I saw one field this season in which the matter was fairly tested. In the portion planted north and south, the crop was laid prostrate; in that part, on the contrary, wherein the rows ranged east and west, the crop was unmoved.

I would especially caution farmers against planting seed without first having testing its capability of germination; then, having satisfied themselves on that point, let care be taken not to plant too thickly. If planted in rows, they should be fully four feet apart; and if planted in drills, about three or four inches between each seed. A reliable machine planter will pay its extra cost in the end; but however planted, and by whomsoever, I repeat, *plant shallow*—not exceeding one inch deep, and half of that depth would be still better. A wheat drill can be used by stopping of the hoes to set the rows to suit. I would prefer drill planting, and doing it well in clean land; it will be found more convenient for stripping, and give a better yield; Southern cane, of course, is all in drill rows about five feet apart.

Very good syrup is being made from almost every variety of soil, but my own experience is in favor of a rich yellow soil, strongly lime, especially when I designed a rich-flavored syrup, regardless of the color, or the extra labor required to clean the coating from the boilers. Mr. Henry Leshner, near Dayton, planted, of the Imphee, upon a gravelly creek bottom, less than the half of an acre, from which he delivered me eight and one-half tons of the best cane I had the past season, the juices marking as high as 15 deg. Baume.

This cane, however remained in the yard about five weeks, and, when worked, the juice possessed very little of the usual green tint, and scarcely changed the color of the litmus, being nearly free of acid. Soils possessing less lime can be greatly improved by the use of it or house ashes upon the hill during the cultivation.

## CHAPTER III.

### CULTIVATION OF THE CANE.

Having made a good selection of soil, as indicated in the preceding chapter, it will be found that in order to place the seed in a position to feel the warmth of the sun, ridge planting will best secure this end. I have found, by passing over the field repeatedly during the early vegetation, that in those hills in a low furrow the seeds were not yet sprouted, while upon the higher position, only three or four feet distant, the young cane was fairly above ground. This led the owner to believe the seed was not good, and hence he proceeded to replant; but, in a few days, the sun shone out with effect, and all the seed came up, but that portion was still behind, and remained so throughout the season. Correct and careful planting is the first important step to insure an early and paying crop. The best results, I believe, have been obtained from planting tolerably thick, say from 8 to 12 seeds to the hill. This tends to prevent tillering, and is believed to hasten the maturity of the crop, as it is the larger stalks that are the latest in maturing. The soil must expend its vegetating energies before the crop can mature.

I would suggest the propriety of an occasional dressing of common plaster, or plaster of Paris, also lime, taking note of its effect with a view to the future; the great object being to counteract the acid so common in the cane, which, if accomplished in its growth, will avoid the necessity of using re-agents in the manufacturing process. Therefore, the use of these fertilizers should not be for the purpose of producing a larger growth, but a better quality of juice; one susceptible of a more ready crystallization. I have not found the custom of hilling around the stalks advantageous. If the ground is kept clean of weeds, and with an ordinary amount of cultivation or small-plow dressing in the early growth, it will be found ample. Late cultivation has a tendency to protract the growth, and stimulate the growth of suckers upon the upper joints of the stalk. It must be borne in mind that no definite rule can be laid down as an infallible guide in the cultivation of any crop; soils and seasons will require a modification of almost every system.

Upon the subject of culture, Mr. Wray says:

“I have in some instances, soaked the seed of the Imphee for twenty-four and even forty-eight hours, in warm water, previous to planting them, in order to expedite their germination, as seeds so treated will, in warm weather, moist weather, be up in four days afterward; whereas, being planted (during showery weather) without this assistance, they usually take six or seven days for sprouting. If, after planting, dry weather sets in, they will, however, require ten or even fourteen days to appear above ground; but by being well soaked beforehand, this casualty is materially obviated. Hence I hold the practice to be a prudent one.

“The seed requires to be very lightly covered ; for if deeply set, it is liable to rot, should much cold rain occur immediately after ; but lightly covered, it will not be injured by even constant rain.

“I have lost a great deal of seed by planting too deeply, and I shall, therefore, be very cautious never to commit the same error again. If soaked in warm water for twenty-four hours, then planted in a bed, and care taken to keep them properly moist, we may always calculate with certainty on having them an inch above ground in four days (warm weather).”



## CHAPTER IV.

### CUTTING AND HANDLING.

The season to commence gathering the crop will differ greatly in different localities and different seasons, but, as a general rule, may be set at the first of September; and should be proceeded with expeditiously until the crop is secured from danger of frost. The stripping should not commence until the cane has obtained all the benefits possible upon the hill, as the foliage constitute the channels through which the carbon and oxygen of the atmosphere gain access to the juices of the stalk, whereby its saccharine qualities are elaborated. It is strenuously contended by many, that gathering the cane with the leaves on it, and retaining it thus under shelter for some days, it will improve more rapidly than otherwise. Some favor milling it thus, with the leaves. There would be some loss of juice, but whether enough to overbalance the expense of stripping, is hard to decide. One thing is certain, it should be protected from the storm, as the leaves would soon mold, and impart an unpleasant flavor to the syrup.