U. S. DEPARTMENT OF AGRICULTURE
DIVISION OF CHEMISTRY
BULLETIN No. 34

RECORD

OF

EXPERIMENTS WITH SORGHUM

IN

1891

BY

HARVEY W. WILEY

Chemist of the U. S. Department of Agriculture and Director of the Department Sugar Experiment Stations at Runnymede, Florida; Schuyler, Nebraska; and Sterling and Medicine Lodge, Kansas

WITH THE COLLABORATION OF

DR. G. L. SPENCER, MR. A. A. DENTON, AND MR. WIBRAY J. THOMPSON

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF CHEMISTRY,
Washington, D. C., March 21, 1892.

SIR: I have the honor to submit for your inspection and approval the manuscript of Bulletin No. 34, being a record of experiments with sorghum in 1891, conducted under my direction by your orders. The work was accomplished with the collaboration of Dr. G. L. Spencer and Mr. A. A. Denton. Similar work was carried on by Mr. Wibray J. Thompson, but without aid or direction from the Department, at Calumet Plantation, Patterson, La. The manuscript of this work has been kindly furnished by Mr. Thompson, with permission to incorporate it in our report.

I have the honor to be, respectfully,

H. W. WILEY,
Chemist.

Hon. J. M. RUSK,
Secretary of Agriculture.

EXPERIMENTS WITH SORGHUM IN 1891.

USE OF ALCOHOL IN THE MANUFACTURE OF SUGAR FROM SORGHUM.

The proposal to use alcohol in the manufacture of sugar from sorghum is not claimed as new by the Department. Many years ago a French chemist, H. Joulie, published a work on sorghum sugar, entitled "Etudes et Experiences sur le Sorgho a Sucre," published in Paris in 1864. On pages 106 *et seq* he speaks of a proposed method for the manufacture of sugar from sorghum by the use of alcohol, in which the alcohol was applied directly to the expressed juice of the cane.

There is no doubt of the fact that this method would work admirably, and the only objection to it is in respect of the great amount of alcohol which would be required. For this reason it will never be adopted in practice unless alcohol should become very much cheaper than it ever has been in the markets of the world.

The method described by M. Joulie is as follows:

As the juice comes from the mill it is immediately saturated with a little lime and mixed with an equal volume of alcohol of 44° strength and left at rest. After twenty-four hours the larger part of the liquid, which is perfectly clear, is decanted. The rest of it is thrown upon a filter or put in filter bags, from which the liquid rapidly runs and it is afterwards submitted to a press, in order to extract the last portions of the alcoholic juice. The matters remaining in the filter press contain the albumen and starchy matters. These bodies can be employed for feeding cattle, or, better, converted into sugar and transformed into alcohol. The clear alcoholic liquid obtained as above is submitted to distillation in order to recover the alcohol, and there will be found in the kettle of the still a sirup which, when evaporated to the crystallizing point, is scarcely at all colored and furnishes an easy and abundant crystallization.

From the above description it will be seen that the method proposed by Joulie, which was never practiced except in the laboratory, is essentially the same as that which was adopted by the Department of Agriculture, with the exception of the stage of the process at which the alcohol is applied.

One special reason for the method proposed by Joulie, as urged by him, was that it secured a cold defecation of the juice and thus avoided the conversion of the starch which the juice contains into dextrin. Joulie seemed to be unaware of the presence of gums other than dextrin and starch in the sorghum juices. His idea was based upon the fact that if the juice should be previously heated the starch would be rendered perfectly soluble.

The process of Joulie, moreover, could only be employed with mill juices, and not with advantage with diffusion juices, which are much more dilute than mill juices and would require a much larger quantity of alcohol.

Several years before Joulie proposed to use alcohol for making sugar from sorghum an English patent No. 655, issued March 27, 1858, was granted to William Armond Gilbee for the use of alcohol in the manufacture of sugar. This process had been described to Mr. Gilbee by a foreigner, whose name is not mentioned. The process is described in the patent in the following words:

I will now describe the application of the process to the treatment of the saccharine matter contained in beet root, which will enable the invention to be applied to other kinds of saccharine fluids with facility.

As it would not be economical to employ alcohol as the purifying agent in treating juice of weak density, if the juice be produced by the pressure or maceration of green beet root, it should be previously concentrated from eighteen degrees to thirty degrees, Baumé's areometer, either after defecation in the ordinary manner or direct, care being taken to neutralise the acidity of the syrup, as soon as it appears, by lime or other base. Dried beet root, treated by washing with boiling water and its acidity neutralized by the addition of a small quantity of slaked lime, produces syrups of the desired degree of concentration.

Crude and impure syrups, however obtained, if too alkaline, are first neutralized by carbonic or sulphuric acid, and then conveyed into a closed sheet-iron vessel provided with an agitator. Alcohol is then made to enter on it through a pipe furnished with a stop-cock, which pipe puts the above vessel in communication with a receiver placed at a higher level. The quantity of alcohol to be introduced is proportionate to its degree of strength and the degree of concentration of the syrup operated upon. The proportions must be such that the mixture will mark sixty degrees to seventy degrees by Guy Lussac's alcoholimeter; three volumes of alcohol at ninety-three degrees and one volume of syrup at twenty degrees Baumé are the suitable proportions for this mixture. After agitating the mixture during a few minutes it is allowed to settle; the deposit thus formed is grumous, and may easily be separated by decantation, when an excess of acid or alkali has not produced too great a transformation of the pectin. A small quantity of sugar, according to the degree of concentration of the syrup, remains mixed with the impurities which form the deposit. The deposit may be either washed several times with alcohol (which will serve for a subsequent precipitation) or, after being freed from alcohol by passing through it a jet of steam, it may be used like molasses in distilleries. The liquid thus obtained is clear and nearly colorless, and is conveyed by difference of level, by an exhaust pump, by steam pressure, or by other mechanical means into a vessel similar to the first, provided with a funnel furnished with a stop-cock for introducing the purifying agents; an acid or an acid salt, such as sulphuric, oxalic, or tartaric acid, and sulphate of alumina, forming with potash and soda insoluble compounds in alcohol, will separate these alkalies.

The alkaline salts precipitated are nearly white and collect with more or less rapidity, and their value varies according as the acid employed is a mineral or organic acid, and of more or less high price, the choice of which is determined by circumstances. I prefer using sulphuric acid diluted in alcohol. The quantity to be employed is indicated by the cessation of precipitate. I operate in a cold state, and agitate carefully; as soon as the acid has been added I neutralize the excess of acid and the acids which it has displaced by a base of lime barytes, strontian, oxide of lead, or other suitable base or one of their basic salts. I introduce into the liquid, separated from the alkaline salts, one of these bases in excess, previously diluted in

weak alcohol; an abundant precipitate then forms. These bases serve to expel the ammonia and prevent acidity toward the boiling. The vessel in which I operate is provided with a worm which allows of heating by steam. Upon heating, the ammonia is expelled and drawn along by the alcoholic vapors, and passes into a recipient containing alcohol acidulated by sulphuric acid or sulphate of alumina. The ammonia condenses and forms a useful product, and the alcoholic vapors pass into a refrigerator to become condensed into a liquid state. This operation being finished, I remove the base in excess and at the same time decompose, by a suitable acid or by a current of carbonic acid, the small quantity of saccharine matter produced. I separate the deposit, and pour the clear liquid in a separate boiler heated by steam, which boiler serves at the same time as an evaporating apparatus and an alembic, so that the alcohol is condensed for a subsequent operation, and the saccharine matter is concentrated into a syrup, which may then either be boiled or submitted to the ordinary process of clarification, and also to that of filtration, when it is freed from alcohol at about thirty degrees Baumé, in case its nature does not permit of avoiding this manipulation.

All the operations are performed in closed vessels. The precipitates are separated by decantation. If the precipitates are light and voluminous, I accelerate their deposit by adding, a short time after they are formed, a body coagulable in alcohol, such as albumen or gelatine, which bodies are capable of drawing all the particles in suspension into a perfectly coherent deposit. When a sufficient quantity of the deposits is accumulated in a vessel they are washed with strong alcohol to separate from them the sugar with which they are impregnated, then the alcohol is expelled by heat, before the deposits are passed off through an opening made for that purpose. When I employ carbonic acid, to avoid the loss of alcohol, I cause the acid to be absorbed by a base as it escapes from the liquid. This mode of operating permits the employment of animal black in its most efficient state, namely, when new and in fine powder. For this purpose it is necessary to add it to the sirup, which permits it to act before the alcohol, by which it is precipitated with all the impurities.

The means adopted for condensing the alcohol should be such as to allow of a rapid evaporation of the liquids, and prevent a large quantity of alcohol being used without having to employ various epurating agents, as herein stated. By means of alcohol and lime, a sugar of great whiteness may be obtained from beetroot. For this purpose it is necessary to introduce lime in excess into the liquid separated from the deposit formed by the alcohol, then to boil, condense the ammonia and alcoholic vapours, as before described, afterwards to neutralize the excess of base, separate the deposit, evaporate, and boil. Instead of adding the lime to the alcoholic solution, it may be added to the sirup at 27° to 30° Baumé after the evaporation of the alcohol; I then clarify, filter, and boil. It will be easily understood from the above description, that the principle on which this invention is based is the employment of any liquid dissolving sugar without deteriorating its saccharine properties, and in which the solubility of the matters in combination is modified; and also the employment of any body forming in such dissolving liquid an insoluble compound with one of the foreign elements of the sugar, and easy of elimination.

Having thus described the nature of the invention communicated to me, and the manner in which the same is to be performed, I would observe, in conclusion, that I do not confine myself to the precise agents herein named, but what I claim and desire to secure by letters patent is, the application to the treatment of saccharine fluids of alcohol and agents capable of effecting in conjunction with alcohol the elimination of mineral or organic matters which are mixed with the sugar in the juices of saccharíferous plants, as hereinbefore described.

In witness whereof, I, the said William Armand Gilbee, have hereunto set my hand and seal, this twenty-second day of September, one thousand eight hundred and fifty-eight.

[L. S.] W. A. Gilbee.

The principle of the method practiced by the Department rests on a different basis from that described by Gilbee. The chief object of the method of Gilbee is to get rid of the alkaline salts of beet syrup, while the object of the experiments carried on by us was to separate the uncrystallizable carbohydrates. While the method of Gilbee embodies the main process of our method, it is seen without discussion that it could not be applied economically.

It is but just to say that our method was developed, perfected, and carried out in its experimental work before our attention was called to patent of Gilbee in March, 1892, by Prof. C. A. O. Rosell, of the Patent Office.

The use of alcohol for precipitating gums for chemical purposes has long been practiced. Its application to sorghum molasses for this purpose is described by Dr. Peter Collier and Mr. Clifford Richardson in the Annual Report of the Department of Agriculture for 1878, page 107.

ABSTRACT OF METHOD USED IN EXPERIMENTAL WORK.

The process of manufacturing sugar from sorghum by the alcohol process, as carried on by the Department in its experimental factory at Medicine Lodge, may be briefly described as follows:

The cane when brought from the field is passed through a cutting apparatus and cut into pieces about 1 inch in length. These pieces of canes, together with the short pieces of blades, are next carried to a fanning machine, by which the blades and other light particles are entirely removed. The clean pieces of canes are next conducted to a shredding machine, in which they are torn into as small bits as possible, the finer the better. The pulp thus prepared is elevated above the center of the diffusion battery, whence it is conducted into the cells of the battery by a swinging funnel. The diffusion juices are collected into clarifying tanks, neutralized with lime, the temperature raised to the boiling point and the skimmings removed in the usual way. The clarified juices are then left to stand in the clarifying tanks until the sediment has fully settled when the clear juice is drawn off and sent to the multiple-effect evaporating apparatus. The sediments are collected in a separate tank and reclarified, being either rejected, passed through a filter press or returned to the cells of the battery.

In the multiple effect the sugar juices are concentrated to a sirup containing about 55 per cent of solid matter. This sirup is then conveyed to tall cylindrical tanks, each one being filled to little less than half its depth. An equal volume of 90 per cent alcohol is then added and the whole thoroughly stirred together by blowing cold air in at the bottom of the tank. As soon as the sirup and alcohol are thoroughly mixed the impurities of the sirup are precipitated in flocculent masses. The whole is then allowed to stand for a few hours, if time permits for twenty-four hours, when it is found that the precipitated matters have settled nicely to the bottom of the tank, leaving a clear alcoholic sirup

above. This clear liquor is then drawn off, and is sent at once to the still for the recovery of the alcohol. The sediment, or mud, is passed through a filter press, by means of which the alcoholic sirup is removed and the mud left in the form of a hard, firm cake, containing a greater or less percentage of sugar and alcohol, according as the cake is hard and well pressed. In passing the alcoholic sirup through the still the alcohol is entirely removed and the sirup is ready for concentration in the vacuum pan. The boiling in the vacuum pan is conducted in the same way as for ordinary sirups.

The sirups treated in this way boil with the greatest ease, forming beautiful crystals in the pan, which are purged with no difficulty whatever in the centrifugals. With massecuite formed from such sirup it is possible to fill the centrifugals with a maximum charge and to have the sugar thoroughly dried within two minutes.

It appears from the experiments which were conducted that one of the chief advantages of this process is not so much in the increased yield of sugar as in the ease with which the material can be passed through the sugar factory. With ordinary sorghum massecuite it is necessary to run a centrifugal machine from fifteen to thirty minutes in order to dry a very small charge, while with massecuite made by the alcohol process from two to five minutes have been found to be entirely sufficient for the maximum charge.

A detailed description of methods and machinery employed will be given further on.

DISPOSITION OF THE PRESS CAKES.

The proper disposition of the gums secured in press cakes is a matter of no little importance. As indicated in this report, the press cakes not only contain the gums and other bodies precipitated by alcohol, but also considerable quantities of alcohol and of sugar. The chief loss of alcohol and sugar in the process was found in the press cakes. The necessity of preventing these losses when manufacturing on a large scale will be at once apparent. In the modification of the filter press as proposed much of the loss of the alcohol and sugar will be avoided, but there is no disposition of the press cakes which will enable the manufacturer to escape altogether from this loss.

The most obvious as well as the most easy disposition of the filter cakes is to subject them to fermentation and thus make them the source of alcohol necessarily lost in the other parts of the process. The experiments clearly show that these press cakes alone will furnish sufficient alcohol to make up for this loss during the process of manufacture. Not only could the alcohol which they contain be thus recovered, but the sugar which is found in them will be converted into alcohol, together with the fermentable gums of the press cake itself. There is no other use to which the press cakes could be put which seems so plausible or scientific.

CHANGES IN THE REVENUE LAWS NECESSARY TO THE PRACTICAL WORKING OF THE PROCESS.

The practical working of the alcohol process in the manufacture of sugar from sorghum, or from sugar cane or beets, if it should be applied to these bodies, depends largely upon the legal aspects of the case. Under our present system of internal revenue it would be very difficult to devise a system of regulations which would at the same time secure the revenue against fraud and allow the manufacturer a sufficient freedom of action to the success of his work. Any system of revenue control which would require the manufacturer to pay loss on evaporation or accidental loss of alcohol, or which would require him at the end of every twenty-four or forty-eight hours or some similar period to re-store and re-gauge the alcohol in use, would entirely defeat any attempt at successful manufacture. In order that the manufacture be successful the operator must have full power to use the alcohol in any way he sees fit and at such times as may be necessary, accounting only for the residue at the end of the manufacturing season or at the time of going out of the business.

In my opinion there would be no difficulty whatever in securing complete immunity from fraud in allowing the use of alcohol in this way. The revenue laws should also be so amended as to permit the manufacturer of sugar to use the waste products of the factory for the manufacture of his own alcohol. He is required by the process itself to have all the stills and other apparatus necessary to the manufacture of alcohol on hand, and the alcohol necessary to the process could be manufactured during the interval between two successive sugar seasons, so that the apparatus could be kept in more constant use and the manufacturer be relieved from the necessity of purchasing his alcohol from outside sources, where the cost would not only be higher but the item of transportation be of no little importance.

It is believed that the sugar manufacturer himself can produce his own alcohol at a cost, probably, of not more than 7 or 8 cents per proof gallon.

The regulations at present in force on this subject are published as "Series 7, No. 7, Revised, Supplement No. 1," of the United States internal revenue, and can be secured by addressing a request therefor to the Commissioner of Internal Revenue, Washington, D. C.

MACHINERY AND METHODS.

The entire outfit of machinery, with the exception of the filter presses and the distilling apparatus, was manufactured by the Walburn-Swenson Manufacturing Company, of Fort Scott, Kans.

The machinery, though constructed on a small scale, is of large enough capacity to be thoroughly practical in all its operations.

The cane was prepared for the battery by the Hughes process.

The diffusion battery consists of twelve cells, arranged in a circle. The nominal capacity is 25 tons in twenty-four hours, though with rapid cutting a capacity of 1.6 tons per hour has been exceeded.

From the diffusion battery the juice passes to the clarifiers of the construction ordinarily employed in Louisiana. The skimmings were measured and rejected, though at the first of the experimental work they were returned to the diffusion battery.

The clarified juice was concentrated in a triple-effect apparatus to a sirup of 54.3° Brix (30° Baumé). This apparatus was provided with heating tubes of small diameter, the steam passing through the tubes. Attention is especially called to this arrangement of the heating surface, since it was noticeable that the tubes remained clean and free from scales. From the triple effect the sirup was pumped through a cooler to the precipitation tanks. These tanks are 4 feet 6 inches in diameter and 10 feet deep. Each tank was provided with a connection, through a pump, with the filter presses; also an outlet was arranged for drawing off the clear sirup after the subsidence of the matters precipitated by the alcohol. The filter-press pump was also arranged for pumping a current of air into the tank for the purpose of thoroughly mixing its contents.

Experiments were made to ascertain the quantity of alcohol required for the precipitation of the gums. Practice soon demonstrated that with a sirup of 54.3° Brix a volume of alcohol of 90 per cent (by weight), equal to that of the sirup, was sufficient to obtain a rapid deposition of the gums. It was further shown that under these conditions the mixture could easily be filter-pressed, the press yielding firm, hard cakes of gum, which are readily removed from the cloths, leaving the latter in excellent condition for further work. In successful filter-press work in any branch of sugar manufacture it is essential that the removal of the press cake shall leave the cloths free from adhering precipitate. As may be seen from the above statements, this condition and all others for good filter-press work were realized. It seems certainly marvelous that sirup can be made to filter-press as easily and with as good results as the skimmings in a cane-sugar house.

In the work at the Medicine Lodge Experiment Station the clear sirup was drawn off from above the precipitate and the "tank bottoms" containing the precipitate were sent to the press. This method was adopted for convenience in keeping each set of experiments separate.

The clear sirup obtained by decantation and the filtrate from the press were united and pumped to the distilling apparatus for the recovery of the alcohol. The sirup, freed from alcohol, was passed through the usual sugar-house processes of granulation in the vacuum pan and purging in the centrifugals.

The distilling apparatus employed in these experiments is of the continuous type common in Europe. It consists of a "beer still" (Fig. 1) provided with a number of chambers fitted with perforated plates and

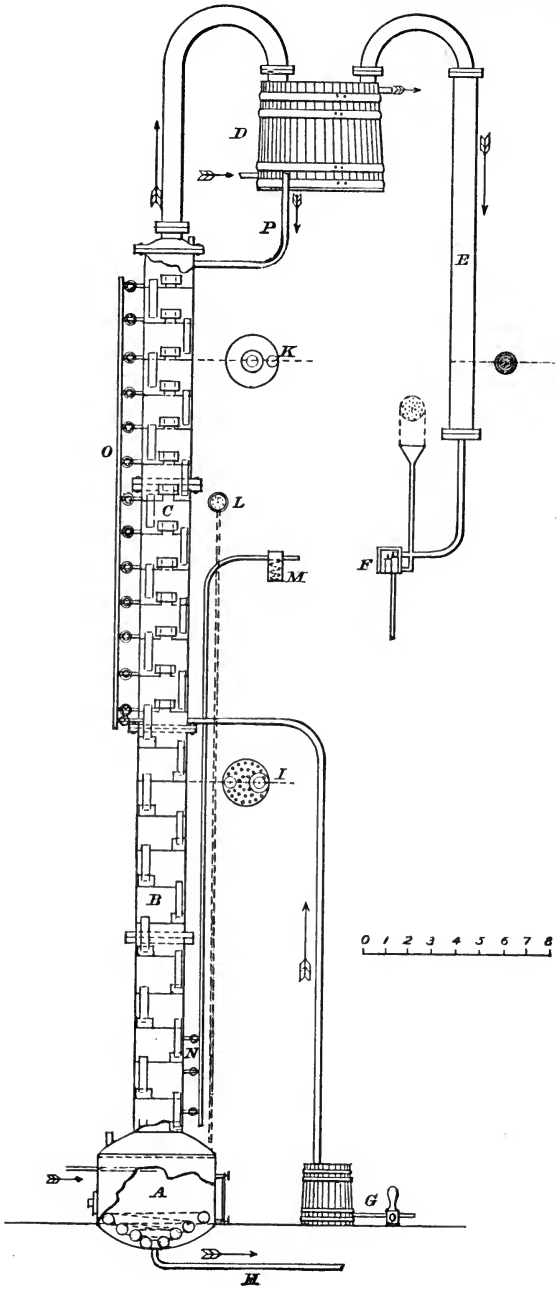

FIG. 1.—Continuous distilling apparatus. Scale, $\frac{1}{8}'' = 1'$.

suitable overflow pipes. The sirup and alcohol are pumped into the top of the beer still through a pipe *G;* steam is admitted through an open pipe into the kettle *A* at the bottom of the column or is produced by heating the spent liquor by means of a coil. The steam ascends through the perforations in the plates, becoming richer and richer in alcohol as it passes through each layer of liquor, while the latter gradually descends by means of the overflow pipes to the bottom of the column *B* and finally reaches the kettle completely exhausted of alcohol, whence it is removed by means of a pump connected with the pipe line *H*. On reaching the top of the beer still *B* the vapors of the alcohol and the steam continue to rise and pass into the alcohol column *C*. This column is also divided into chambers, but by solid instead of perforated plates as shown at *K*. Each chamber is provided with a return or overflow pipe and an opening through which the vapors ascend. In the alcohol column the vapors are so directed as to pass through a layer of liquid more or less rich in alcohol, which is retained by the plate separating the compartments. An excess of liquid in these compartments overflows through the down pipes, gradually works its way into the beer still and thence to the kettle. On reaching the top of the column the vapors, which have now become quite rich in alcohol, are passed into a coil provided with an outlet at the lowest part of each bend. These outlets lead into the return pipe *P* which connects with the top chamber of the alcohol column. This coil is technically termed the "goose" and is immersed in a tank called the "goose tub." A suitable arrangement is provided for controlling the temperature of the water in the tub by means of outlet and inlet water pipes. When the still is in operation the temperature of the "goose" is regulated according to the required density of the alcohol. The object of the "goose" is the return to the column of all low products which condense at a temperature below the boiling point of ethyl alcohol of the desired strength. On leaving the "goose" the vapors enter a condenser *E* whence the liquid alcohol is conducted into a separator *F*. This separator consists simply of a glass box provided with a cylinder through which a current of alcohol is constantly flowing. An alcohol spindle is inserted in this cylinder and shows the density of the spirit at all times. A pipe, with a funnel-shaped opening at its upper extremity, connects with the pipe leading from the condenser and gives vent to any objectionable fumes. The separator is connected by means of a pipe with the alcohol storage tank. The pipe *O* is for emptying the upper chambers when necessary. The valves *N*, communicating by means of a small pipe with a condenser *M*, are for testing the vapors in the lower chambers for alcohol.

Valuable advice and assistance in procuring and arranging the distilling apparatus, were obtained from Mr. Philip Zell and Mr. J. B. Greenhut, of Peoria, Ill. The apparatus was designed by Mr. Zell and constructed by Klingle Brothers, of Peoria.

The vacuum still, which it is proposed to use for the separation of the alcohol from the sirup in place of the apparatus just described, is illustrated in Fig. 2. This illustration simply gives an idea of what such a still should be without any attempt at making it technically perfect.

The object, as indicated, is to separate the alcohol from the sirup at a low temperature, by means of a jet of exhaust steam, in such a way as to secure a minimum dilution of the sirup and the complete separation of the alcohol. The alcohol separated in this way would be of low strength, probably not much above proof spirit, but the sirup would emerge from the still without ever having reached the temperature of boiling water and without any danger of scorching.

Two methods of procedure may be employed. If it is desired to secure the alcohol in a form ready for subsequent condensation the complete apparatus described can be used. If, on the other hand, it is desired to save the heat which would be lost in the condensation of the alcoholic vapors, the vacuum part of the still, that is, the part used for the separation, could be connected directly at the top and to one side with the condensing still. In this process the condensing still would have to operate under a vacuum, and the vacuum apparatus would be simply transferred from the end of the still indicated to the end of the vacuum still. The condensing, or alcohol still, would be placed above and to one side of the beer still, and be provided with a separate scroll or steam jet. Inasmuch, however, as the specific heat of alcohol vapor is somewhat low there would not be a very great loss of heat in condensing the alcohol in the first place, as indicated, and subjecting the alcohol thus obtained to subsequent distillation.

The still consists of a beer column *B* of ordinary construction. It is furnished at *V* with a vacuum gauge and at *T* with a thermometer. The exhaust steam is admitted through a pipe *S* and escapes through the rose *R* immediately under the first chamber. The chambers of the beer still are separated by perforated diaphragms and connected one with the other with overflow tubes and cups in the usual manner. The sirup enters the still in its upper chamber through the heater *H*, and can be supplied either by a feed pump or from a tank placed higher than *H*. The supply from the tank would be more easily regulated and would be preferred.

The sirup, after it has passed through the still and is freed from alcohol, descends through the tail pipe *P* to the sirup tank *A* opening underneath the level of the sirup in the tank so as to be completely sealed, as indicated. The length of the tail pipe *P* is sufficient to produce a free exit of sirup under the vacuum employed. The sirup in tank *A*, after it has filled the tank to the required level, escapes constantly through the pipe *C* to the sirup pump. At the end of the operation the sirup remaining in *A* can be withdrawn by opening the cock in the pipe *E*.

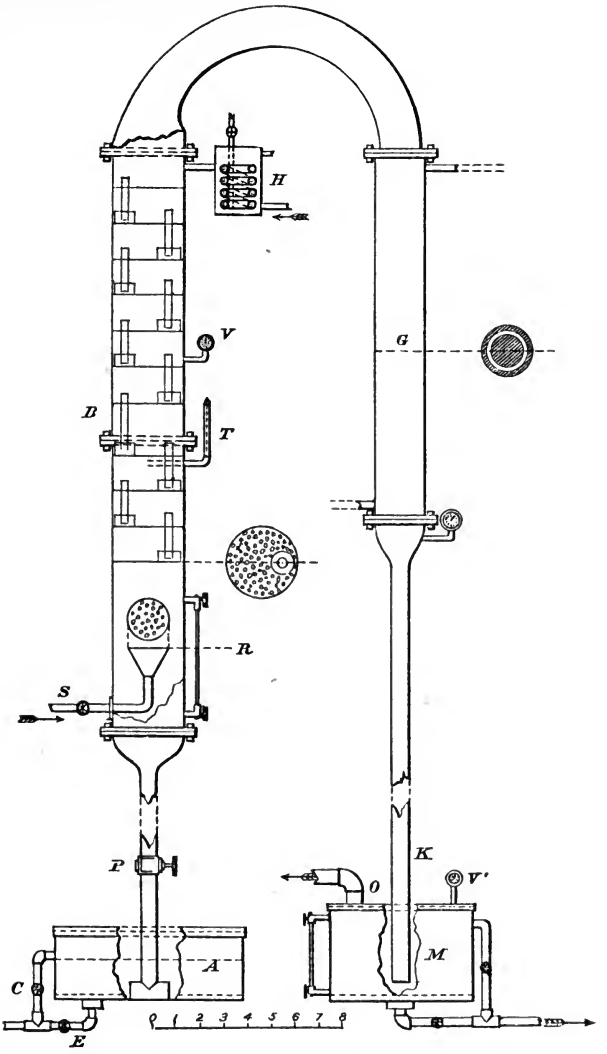

FIG. 2—Vacuum distilling apparatus. Scale, $\frac{1}{8}$'' to 1'.

The dilute alcohol vapor is condensed in the cooler *G*, and flows through the tail pipe *K* to the closed receiving tank *M*, which is furnished with a vacuum gauge *V*, and an outlet to the vacuum pump *O*.

The excess of alcohol, after the tank *M* is filled to the dotted line, is removed through the system of pipes indicated by a pump and sent directly to the condensing still or to a tank arranged to feed that still. The vacuum pump should be operated only sufficiently to secure the necessary vacuum in starting the apparatus and to remove any air which may find entrance.

The tail pipe *K* should be long enough to maintain a proper vacuum. It can be made of equal length with the tail pipe *P*, which, being arranged to receive a heavier liquid, will discharge into the tank *A*.

After leaving the still the sirup is pumped, as has been stated, to the vacuum pan. This purified sirup boils as freely as the cane sirup of the Louisiana plantations. In practice, owing to the small size of the vacuum pan, it was found advisable to introduce a few pounds of sugar into the pan for use in building up the grain. The sirup was concentrated to proof and 50 pounds of fine-grained sugar added. This plan was adopted in order to obtain grain comparable in size with that from sirup boiled in large pans. Owing to the small size of the pan and the free boiling of the sirup the entrainment was considerable, and on the small scale on which the experiments were conducted the percentage of loss was large. With the present pan arrangement this loss was unavoidable, and introduces an element of error which would not obtain in regular manufacture. Sirups not previously treated with alcohol boiled heavily and with little loss from entrainment.

It was quite noticeable that massecuites grained in the pan, from sirups produced by the ordinary process, were difficult to purge, even when left in the hot room a few days. Massecuites from sirup purified by the alcohol process were boiled to a very high proof and were centrifugaled immediately after leaving the vacuum pan. The ease with which the centrifugal work was accomplished is of great importance, since it enabled the rapid drying of the sugar and the manufacture of a product of good polarization without the use of a wash.

DIFFICULTIES ENCOUNTERED.

It is unfortunate that experiments of as great importance as those under consideration must necessarily be made with new machinery. Under these conditions vexatious delays are unavoidable, no matter how carefully the plans may have been carried out. In the present case the experience of the Department and the nature of the experiment rendered a new building and machinery on a small scale a necessity. The work was pushed rapidly from the time of receiving the appropriation, but much was left for the last few weeks, and as a result there were many evidences of hasty and careless work. A great source of vexation was the failure of certain pumps. The losses of time and sirup

occasioned by the failure of the tail pump (sirup) of the triple effect, in several instances, materially reduced the yield of sugars per ton of cane. This pump, after repeated failures, was removed and one of greater power was arranged for this service, but it also proved unequal to the work required. A third pump was built especially for pumping the sirup from the triple effect, and fortunately occasioned few delays. The difficulty seemed to be due to the very small amount of sirup to be removed from the apparatus in proportion to the size of the pump. In order to obviate this difficulty the builders of the machinery suggested and tried pumping back a part of the sirup into the juice tank and thus obtaining a greater volume of liquor for the pump to work upon. As far as the pump was concerned this plan worked fairly well, but from a sugar-making point of view it was far from successful. It is obvious that in this method of working a part of the sirup may be retained in the apparatus many hours and suffer deterioration. That this was undoubtedly the case was evidenced by the large inversion which ocurred at times when this method was practiced. But in this case a remedy was essential to the continuance of the experiments, and this bad remedy was the only one available at the time.

The delays due to other pumps were numerous. The pump to remove the sirup from the still practically failed to accomplish this work, and, after vexatious delays and the loss of considerable sugar, it was replaced by another, which worked only fairly well. The removal of the sirup from the still was a constant source of annoyance throughout the experiments. The fault was probably in the use of a pump not adapted to pumping sirup heated to very nearly its boiling point.

The construction of the still was such that sirups were heated to a high temperature, which was maintained during long periods. This is manifestly contrary to the maxims of good sugar-making. Apparatus designed to obviate this difficulty has already been described.

It is probable that the methods of vacuum evaporation employing thin films of liquor could be successfully employed in the recovery of the alcohol. The Yaryan Company have constructed an apparatus for use in dehydrating wine, which they claim is successful. This apparatus separates the alcohol and a portion of the water from the wine, rejects the water and returns the alcohol to the mother liquor. The alcohol furnished by this apparatus would probably be of low concentration, but could easily be increased in strength by a second distillation. In this method the operations are performed in partial vacuo and subject the sirup to a low temperature for a very short time.

The filter presses were the greatest source of loss of alcohol. This was not due to any fault in the press as built for ordinary sugar-house work. For work with alcohol, the press should be so arranged as to minimize losses by evaporation. In order to accomplish this a special construction is necessary. All cloth surfaces should be covered, since the alcohol and sirup mixture will follow the cloth, no matter how

tightly the press may be closed. The alcohol soon evaporates from the cloth and leaves the latter sticky with sugar solution. It would probably be easy to arrange a metal cover for the press which would prevent or diminish this loss. An arrangement should also be provided to avoid the exposure of the alcohol sirup to the open air and thus prevent the evaporation of the alcohol. In the ordinary press the alcohol must fall through a space of 2 feet or more before reaching the trough. This loss can not occur in a press arranged as shown in the accompanying sketch (Fig. 3). In this press the filtered sirup passes into a channel *C*, and from there through a pipe line to the receiving tank. The cocks *A* and *B* are so arranged that one can draw a test sample either from the channel or the filter plate. The channel *E* is for dilute alcohol and *D* the sirup alcohol mixture. The pipe line for filtered sirup should be provided with sight glasses in order to promptly detect the flow of turbid sirup. As soon as the flow of turbid sirup is detected, the opening into the channel at the proper place should be closed. From time to time the sirup from the closed plate should be examined, since ordinarily after a short time it will flow clear.

It is probable that filter bags could be employed with economy in the filtration of these sirups. If so, the cost of the filtering plant would be materially reduced. By means of the improved apparatus suggested, the sirup-alcohol mixture would be out of contact with the air at all times and the loss of alcohol from evaporation would be reduced to a minimum.

The loss of alcohol (calculated as absolute) in the filter-press cake ranged from 3.7 per cent to 15.9 per cent of the weight of the press cake, or to an approximate average of 3.5 pounds per ton of clean cane, or to .5 gallon 90 per cent (by weight) alcohol. This loss would be considerably smaller in working on a large scale, since then there would always be sufficient material to produce a firm, hard press cake containing a high proportion of solid matters.

Press-cakes have been obtained containing as high as 70 per cent of solid matter.

The press employed was not provided with a channel for use in displacing the sirup left in the press cake. Such a provision would enable the removal of practically all of the sirup-alcohol mixture from the press-cake, leaving dilute alcohol in its place, thus reducing the amount of sugar and alcohol in this by-product.

Recommendations in regard to the utilization of the press cakes in the manufacture of alcohol are made in another part of this report.

PLAN OF EXPERIMENTS.

The experiments were conducted with a view to the direct comparison of the ordinary and the alcohol processes. It was expected in this way to emphasize the practical difficulties or advantages of either process.

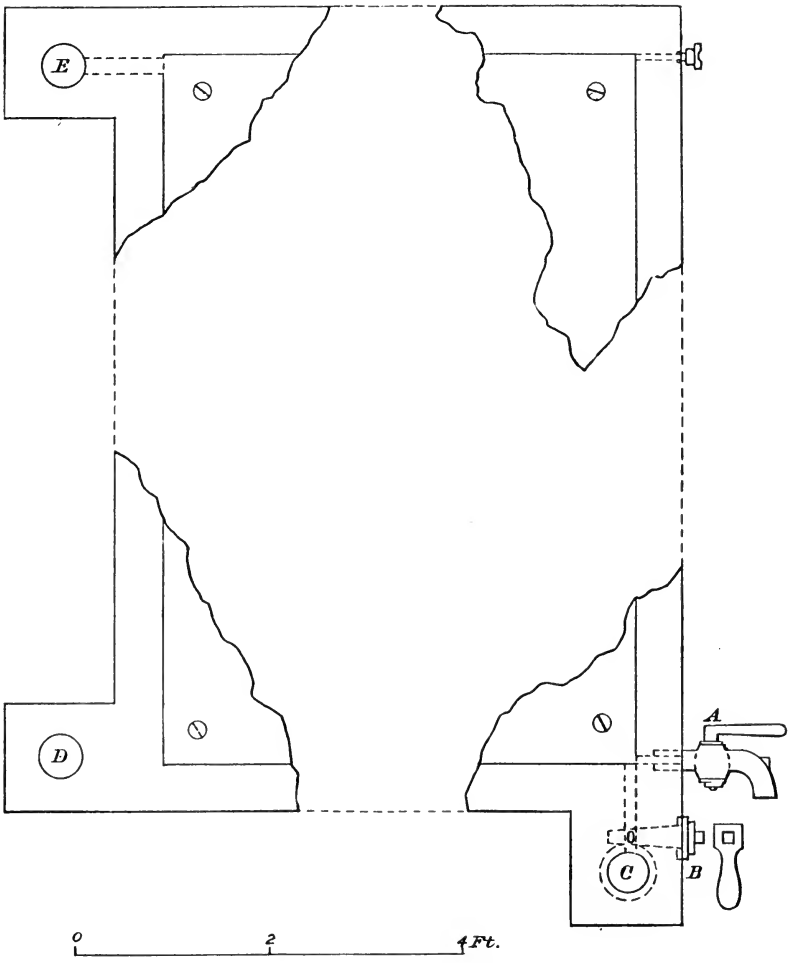

FIG. 3.—Filter-press plate. Scale, 2″ to 6′.

The two processes being identical up to the treatment of the sirup, this was the point chosen for the separation of the work.

The precipitating tanks are provided with an equalizing valve, by means of which the sirup obtained from a given amount of cane, after being thoroughly mixed, may be divided into two equal portions. By this method any loss which may occur between the cane carrier and the precipitation tanks is equally divided between the two sets of experiments.

For uniformity in the statements of the work all experiments by the ordinary process are designated by the letter "A" and those by the alcohol process by "B."

After dividing the sirup into two equal parts, that for the ordinary process was pumped directly to the pan tanks. The pan work in all experiments was conducted under as nearly the same conditions as possible.

Experiments were made on a small scale to ascertain the volume of alcohol required for the treatment of the sirup. A sufficient volume of alcohol is indicated by the prompt deposition of the pecipitate. This condition is essential to a rapid and thorough filtration of the sirup.

These experiments led to the use of a volume of alcohol equal to that of the sirup, provided the density of the latter is approximately 54.3° Brix (30° Baumé). A larger volume of alcohol would be necessary with a more dilute sirup.

After the first eight sets of experiments the work with the ordinary process was discontinued. These parallel experiments caused many delays in the work, and would soon have resulted in a complete blockade of the hot room. It was invariably necessary to run first massecuites, made by the ordinary process, into wagons and keep them warm several days before centrifugaling. A peculiar flat crystal formed in massecuites of this description, which was very difficult to free from the molasses.

The sugars were not washed in the centrifugal.

Several preliminary trials were made to test the machinery and aquaint the workmen with their duties. No record was kept of the work, with the exception of that tabulated in the following pages under the heading Experiment No. 1. After the preliminary trials of the battery it was decided to no longer return the skimmings to the cells. In practical work on a large scale the loss of sugar in the skimmings would be very small, hence in these experiments the skimmings were thoroughly settled, the clear juice drawn off, and the tank bottoms calculated back to cane.

The high dilution of the diffusion juices is due to emptying the battery after each experiment, which necessitates the use of a large quantity of water to remove the sugar from the last ten cells of chips.

EXPERIMENT NO. 1—ORDINARY PROCESS ONLY.

Date: September 24, 1891.

Variety and plat: Black African, from part of plats 2, 5, and 23.

Gross cane (topped cane)	tons	19.1
Trash	do	2.75
Clean cane	do	16.35
Clean cane lost in teaching the workmen and in samples for analysis	do	1.17
Net clean cane worked	do	15.18
Mean weight of clean cane per cell	pounds	322
Trash, per cent topped cane		14.4

*Juice analyses.**

	Normal juice.	Diffusion juice.
Degree Brix	19.55	12.31
Sucrose, per cent	11.69	8.22
Glucose, do	2.89	1.39
Purity coefficient	59.3	66.8
Glucose, per cent sucrose	24.7	16.9

* All analyses by E. G. Runyan and Oma Carr.

Exhausted chips.

Sucrose lost in exhausted chips, per cent cane, 0.76 (mean of twelve analyses).

Yield.

	Pounds.
Weight of first sugar obtained	1,698
Weight of first sugar, per ton clean cane	111.8
Weight of first sugar per ton (net) of topped cane	90.6

EXPERIMENT NO. 2—ORDINARY AND ALCOHOL PROCESSES.

Date: September 25, 1891.

Variety and plats: Black African; plats 2, 5, and 23.

Gross cane (topped cane)	tons	22.475
Trash	do	3.430
Clean cane	do	19.045
Clean cane, removed in samples	do	.120
Skimmings lost, calculated to clean cane	do	.826
Net clean cane worked	do	18.099
Mean weight of clean cane per cell	pounds	349
Trash, per cent topped cane		15.2

Juice analyses.

	Normal juice.	Diffusion juice.
Degree Brix	17.21	11.55
Sucrose, per cent	11.72	8.20
Glucose, do	1.53	1.14
Purity coefficient	68.1	71
Glucose, per cent sucrose	13.1	13.9

Exhausted chips.

Sucrose lost in exhausted chips, per cent cane, 0.84 (mean of seventeen analyses).

Sirups.

The sirup was divided into two equal portions, A and B. A was worked by the ordinary and B by the alcohol process.

The analyses of the sirups before and after treatment are given in parallel columns in the table below:

Analyses of sirup from Black African cane before and after alcoholic treatment.

	A.	B.
Degree Brix	52.20	36.10
Sucrose, per cent	36.70	26.00
Glucose, per cent do	4.95	3.39
Purity coefficient	70.30	72.10
Glucose, per cent sucrose	13.49	13.04

In the above experiment the sirup shows a material increase in purity. The reduction of the density of the sirup is very noticeable. This is due to the condensation of the steam used in the distillation.

In the first experiments, with the still, a coil was used in boiling the spent liquor in the kettle and thus producing the steam requisite in freeing the sirup from alcohol. This is the method employed in certain distilleries, where it is desirable to produce a mash without dilution. Experiment soon demonstrated that the long detention of this sirup in the kettle at a high temperature was very objectionable. To avoid using the coil a pipe was arranged for delivering a jet of steam above the sirup in the kettle and thus remove the alcohol from the descending liquor. The dilution of the sirup is due to the condensation of this steam. In order to further reduce the length of time required for the separation of the alcohol, the flow of cold water was entirely cut off from the goose tub and low-strength alcohol only was produced. This alcohol was about 160 per cent proof, and was afterwards redistilled to obtain the necessary strength.

Yield.

(A) The sirup by the ordinary process yielded 2,512 pounds of first massecuite, from which 1,175 pounds of sugar of 85.5° polarization were obtained. The yield of sugar per cent massecuite was 46.8. Owing to difficulty in granulation this sugar was boiled to string proof and was left in the hot room several days.

(B) The sirup treated by the alcohol process yielded 2,181 pounds of first massecuite and 1,196 pounds of sugar of 92.3° polarization. This sugar was dried in the centrifugal immediately after leaving the vacuum pan. The yield of sugar per cent massecuite was 54.8.

Through an oversight the weight of filter-press cake in Experiment No. 2 was not recorded.

Résumé of yield.

BLACK AFRICAN CANE.

	A.	B.
Clean cane worked tons	*9.049	*9.049
Topped cane worked do	*10.671	*10.671
First massecuite pounds	2,512	2,181
First sugar obtained do	1,175	1,196
Polarization of first sugar degree	85.5	92.3
First sugar obtained reduced to 100° polarization pounds	1,005	1,104
First sugar, per ton clean cane do	129.8	132.2
First sugar, per ton topped cane do	110.1	112.1
First sugar 100° polarization, per ton clean cane do	111.1	122
First sugar 100° polarization, per ton topped cane do	94.1	104.5
Yield of first sugar per acre* do	†1,414	†1,439

* Corrected for samples and skimmings. † Note difference in polarization of the sugars.

It is well to again call attention to the ease with which massecuite obtained by the alcohol process could be purged in the centrifugals, yielding a high polarization sugar without the use of a wash. Massecuites by the ordinary process often contained very flat crystals which would overlap one another and prevent the molasses from passing off.

EXPERIMENT NO. 3.—ORDINARY AND ALCOHOL PROCESSES.

Date: September 29, 1891.

Variety and plats: Colman cane, plats 41 and 11.

Gross cane (topped cane)	tons	22.445
Trash	do	4.330
Clean cane	do	18.115
Clean cane removed in samples	do	.135
Skimmings lost, calculated to clean cane	do	.510
Net clean cane worked	do	17.470
Mean weight of clean cane per cell	pounds	324
Trash, per cent topped cane		19.3

Juice analyses.

	Normal juice.	Diffusion juice.
Degree Brix	19.41	13.43
Sucrose, per cent	14.42	10.41
Glucose, do	1.10	.81
Purity coefficient	74.3	77.5
Glucose, per cent sucrose	7.63	7.78

Exhausted chips.

Sucrose lost in the exhausted chips, per cent cane, 0.74 (mean of fifteen analyses).

Sirups.

The sirup was divided into equal parts, A and B. A was worked by the ordinary and B by the alcohol process, as under experiment No. 2. The analysis of the sirup is given in the table below:

	A.
Degree Brix	53.57
Sucrose, per cent	40.20
Glucose, do	4.29
Purity coefficient	75
Glucose, per cent sucrose	10.61

No analyses were made of the sirup after treatment, owing to a laboratory accident which resulted in the loss of the sample.

Filter-press cake.

The following is the analysis of the filter-press cake:

Total solids	per cent	52.3
Sucrose	do	19.2
Alcohol (absolute)	do	14.3
Weight of press cake	pounds	316

The loss of sucrose in the press cake was 60.7 pounds and of alcohol 45.2 pounds. Both these losses could easily be reduced by systematic washing of the press cake with dilute alcohol. Neither of these losses is a serious matter if the press cake is to be utilized in the manufacture of alcohol.

Yield.

(A) The sirup, by the ordinary process, boiled to string proof, yielded 2,535 pounds first massecuite, and 1,370 pounds first sugar polarizing 84.2°. The yield of sugar per cent massecuite was 54.

The molasses from the above gave 375 pounds second sugar, polarizing 79.9°.

(B) That portion of the sirup treated by the alcohol process yielded 2,212 pounds first massecuite, and 1,330 pounds first sugar, polarizing 93.7°. The yield of sugar per cent massecuite was 60.1.

The second massecuite was melted by the carelessness of a workman in placing it too near the steam pipes, hence no statement of this sugar can be given.

REMARKS ON THE YIELD.

In both these experiments there has been a heavy loss of sugar after reaching the sirup stage. Up to the sirup there was a considerable loss by inversion. The weights of the massecuites, allowing for the solids in the press cake, bear the proper relations to one another, but since there was a large known loss of sirup at the still there must have been a loss at the vacuum pan to offset it. Extreme caution was necessary in boiling the pan to reduce the risk of loss, but even then there were undoubtedly losses at this point in the manufacture. The loss at the pan in the A portion was probably due to the liquor boiling over. In the case of the B portion, entrainment was probably the cause of the loss. The sirup boiled very freely.

Résumé of yield.

COLMAN CANE.

	A.	B.
Clean cane worked ..... tons..	*8.735	*8.735
Topped cane worked ..... do....	*10.824	*10.824
First massecuite ..... pounds..	2535	2212
First sugar obtained ..... do....	1370	1330
Polarization of first sugar ..... degrees..	84.2	93.7
First sugar obtained reduced to 100° polarization ..... pounds..	1153	1246
First sugar per ton clean cane ..... do....	156.8	152.2
First sugar per ton topped cane ..... do....	126.5	122.8
First sugar, 100° polarization, per ton clean cane ..... do....	132	142.6
First sugar, 100° polarization, per ton topped cane ..... do....	106.5	115.1
Second sugar obtained ..... do....	375	.....
Polarization of second sugar ..... degrees..	79.9	.....
Second sugar obtained reduced to 100° polarization ..... pounds..	300	.....
Second sugar per ton clean cane ..... do....	42.9	.....
Second sugar per ton topped cane ..... do....	34.6	.....
Second sugar, 100° polarization, per ton clean cane ..... do....	34.3	.....
Second sugar, 100° polarization, per ton topped cane ..... do....	27.7	.....
Yield of first sugar per acre ..... do....	*1,272	*1,375
Yield of second sugar per acre ..... do....	*414	.....

* Corrected for samples and skimmings.

EXPERIMENT NO. 4.

The cane employed in this experiment was Variety No. 160. When 12½ rows of cane had been cut the work was stopped by rain. The cane was cut September 30 and left in the shed until October 3, when, the rain not ceasing, it was worked. All the sirup was treated with alcohol and boiled to grain. The grain was very fine, but nevertheless an attempt was made to centrifugal it, but this ended in failure. An effort was made to melt this massecuite, but the mixer leaked so badly that the

entire experiment was abandoned. The analyses of the juices and sirup only are given:

Analyses of juices and sirup from cane—Variety No. 160.

	Normal juice.	Diffusion juice.	Sirup after treatment with alcohol.
Degree Brix	17.62	10.53	52.07
Sucrose, per cent	11.55	7.19	34.50
Glucose, do	1.28	.75	4.25
Purity coefficient	65.6	68.3	66.2
Glucose, per cent sucrose	11.08	10.43	12.32

This sirup has evidently deteriorated in the processes of manufacture. The reduction in the purity is due to inversion in the triple effect.

EXPERIMENT NO. 5—ORDINARY AND ALCOHOL PROCESSES.

Date: October 7, 1891.

Variety and plats: Early orange; plats 8 and 32.

Gross cane (topped cane)	tons	24.375
Trash	do	5.035
Clean cane	do	19.340
Clean cane removed in samples	do	.142
Cane lost on account of bad weather	do	.899
Skimmings lost, calculated to clean cane	do	.983
Net clean cane worked	do	17.315
Mean weight of clean cane per cell	pounds	319
Trash, per cent clean cane		20.7

Juice analyses.

	Normal juice.	Diffusion juice.
Degree Brix	17.61	12.33
Sucrose, per cent	12.27	8.03
Glucose, do	1.55	1.06
Purity coefficient	69.7	65.1
Glucose, per cent sucrose	12.63	13.20

Exhausted chips.

Sucrose lost in the exhausted chips, per cent cane, 0.97 (mean of seventeen analyses).

Sirups.

The sirup was divided into equal parts, A and B, and the B portion treated with alcohol. The analyses before and after treatment are given below:

	A.	B.
Degree Brix	50.78	26.78
Sucrose, per cent	36.85	21.47
Glucose, do	2.81	2
Purity coefficient	72.6	80.2
Glucose, per cent sucrose	7.62	9.34

The density of the sirup was very materially reduced in the distillation process, but, as has been stated, this can not be avoided with the apparatus as now constructed. In actual practice this would necessitate a large increase in the coal consumption. It is believed that with apparatus constructed after the experience of this work this increase in coal consumption could be almost entirely avoided.

Filter-press cake.

The following is the analysis of the filter-press cake:

Total solids	per cent..	51.25
Sucrose	do...	12.80
Alcohol (absolute)	do...	15.16
Weight of filter-press cake	pounds..	250

The loss of sucrose in the press cake was 32 pounds and of alcohol 37.9 pounds.

Yield.

(A) This sirup was boiled to string proof. Experience demonstrated that with the small pan, in boiling sirups not treated with alcohol, nothing is gained by adding sugar as a nucleus upon which to build grain.

The weight of first massecuite obtained was 2,671 pounds and of first sugar 1,253 pounds. The sugar polarized 85.4°. The yield of first sugar per cent massecuite was 46.9.

(B) In this experiment the sirup treated by alcohol was concentrated to about proof in the vacuum pan and then 50 pounds of very fine-grained sugar were added. The man-hole cover was removed and the sugar thrown directly on the concentrated sirup. A small quantity of grain was formed in addition to that supplied by the sugar. In all the strikes to which sugar was added this plan was followed.

The weight of first massecuite obtained was 2,431 pounds and the yield of first sugar 1,402 pounds, or 57.7 per cent massecuite. The first sugar polarized 93.7°. Deducting 50 pounds (the sugar added), we have net yield of 1,352 pounds sugar. This deduction is, perhaps, not a perfectly fair one, since a portion of the 50 pounds sugar was left in the molasses.

In both these experiments ("A" and "B") the second massecuite was not ready for the centrifugal at the end of the season.

Résumé of yield.

EARLY ORANGE CANE.

		A.	B.
Clean cane worked	tons..	*8.658	*8.658
Topped cane worked	do....	*10.918	*10.918
First massecuite	pounds..	2,671	†2,381
First sugar obtained	do....	1,253	†1,352
Polarization of first sugar	degrees..	85.4	93.7
First sugar obtained reduced to 100° polarization	pounds..	1,070	1,267
First sugar, per ton clean cane	do....	144.7	156.2
First sugar, per ton topped cane	do....	114.7	123.8
First sugar, 100° polarization, per ton clean cane	do....	123.6	146.3
First sugar, 100° polarization, per ton topped cane	do....	98	116
Yield of first sugar per acre	do....	*1,285	*1,387

* Corrected for samples and skimmings. † Fifty pounds deducted for sugar added.

EXPERIMENT NO. 6.—ORDINARY AND ALCOHOL PROCESSES.

Date: October 9, 1891.

Variety and plat: Link's hybrid, plat 29.

Gross cane (topped cane)	tons	25.400
Trash	do	5.010
Clean cane	do	20.390
Clean cane removed in samples	do	.157
Skimmings lost, calculated to clean cane	do	.698
Net clean cane worked	do	19.535
Mean weight of clean cane per cell	pounds	314
Trash, per cent topped cane		19.7

Juice analyses.

	Normal juice.	Diffusion juice.
Degree Brix	19.08	11.98
Sucrose, per cent	13.82	8.87
Glucose, do	.76	.47
Purity coefficient	72.40	.74
Glucose, per cent sucrose	5.10	5.25

Exhausted Chips.

Sucrose left in the exhausted chips: per cent cane, 0.78 (mean of nineteen analyses).

*Sirups.**

	A.	B.
Degree Brix	53.60	32.43
Sucrose, per cent	40.40	25.80
Glucose, do	1.78	1.18
Purity coefficient	75.40	79.60
Glucose, per cent sucrose	4.63	4.59

* A, treated by the ordinary process; B, alcohol process.

Filter-press cake.

Total solids	per cent	61.51
Sucrose	do	9.60
Alcohol (absolute)	do	8.22
Weight of filter-press cake	pounds	350

The loss of sucrose in the press cake was 24.9 pounds and of alcohol 28.8 pounds.

Yield.

(A) This sirup was boiled to string proof. The yield of first sugar was 1,373 pounds and of second sugar 408 pounds. The polarization of the first sugar was 82.5° and of the second sugar 83.5°.

(B) That portion of the sirup treated by the alcohol process was boiled to grain, yielding 2,565 pounds of massecuite and 1,502 pounds of first sugar. The yield of first sugar per cent of massecuite was 58.6. The first sugar polarized 93.8°. The second sugar was left in the wagons to grain, but was not ready for the centrifugal at the end of the season.

Fifty pounds of fine-grain sugar were added to the sirup (concentrated to proof) as in experiment No. 5. Deducting this sugar from 1,502 pounds, we have 1,452 pounds. as the net yield of first sugar.

Résumé of yield.

LINK'S HYBRID CANE.

		A.	B.
Clean cane worked	tons	*9.767	*9.767
Topped cane worked	do	*12.162	*12.162
First massecuite	pounds	.....	†2,515
First sugar obtained	do	1,373	†1,452
Polarization of first sugar	degrees	82.5	93.8
First sugar reduced to 100° polarization	pounds	1,133	†1,362
First sugar, per ton clean cane	do	140.5	149.7
First sugar, per ton topped cane	do	112.8	119.4
First sugar, 100° polarization, per ton clean cane	do	116	139.4
First sugar, 100° polarization, per ton topped cane	do	93.1	111.8
Second sugar obtained	do	408	.....
Polarization of second sugar	degrees	82.5	.....
Second sugar reduced to 100° polarization	pounds	340	.....
Second sugar, per ton clean cane	do	41.7	.....
Second sugar, per ton topped cane	do	33.5	.....
Second sugar, 100° polarization, per ton clean cane	do	34.8	.....
Second sugar, 100° polarization, per ton topped cane	do	27.8	.....
Yield of first sugar per acre	do	1,433	1,516
Yield of second sugar per acre	do	427	.....

*Correction made for samples and skimmings.
†Fifty pounds deduction for sugar added to massecuite in strike pan.

EXPERIMENT NO. 7—ORDINARY AND ALCOHOL PROCESSES.

Date: October 12, 1891.
Variety and plat: Undendebule (Collier); plat 14.

Gross cane (topped cane)	tons	25.515
Trash	do	4.640
Clean cane	do	20.875
Clean cane lost (work of October 10)*	do	2.829
Clean cane removed in samples	do	.122
Skimmings lost, calculated to clean cane	do	.612
Net clean cane worked	do	17.310
Mean weight of cane per cell	pounds	314
Trash, per cent topped cane		18.2

Juice analyses.

		Normal juice.	Diffusion juice.
Degree Brix		20.82	11.68
Sucrose	per cent	15.02	8.55
Glucose	do	1.29	.67
Purity coefficient		72.10	73.20
Glucose per cent sucrose		8.62	7.33

Exhausted chips.

Sucrose lost in the exhausted chips, per cent cane, 0.82 (mean of seventeen analyses).

*This experiment was commenced October 10, but owing to failure to secure a supply of cane the work was stopped and the juice rejected.

Sirups.

	A.	B.
Degree brix	56.26	25.18
Sucrose.....per cent..	40.30	20.53
Glucose.....do....	2.75	1.57
Purity coefficient	71.60	81.50
Glucose, per cent sucrose	6.75	7.64

Filter-press cake.

Weight of filter-press cake, 343 pounds.

The press cake was very soft, owing to a leak in a steam-pipe connecting with the filter press. Through an error on the part of the employé charged with securing samples, the analysis did fairly represent the press cake, so no statements of loss can be made.

Yield.

(A) This portion was boiled to grain, but unfortunately the obstinate flat crystals,* which have been previously mentioned, formed, and although the massecuite was "short," it was impossible to centrifugal it. After remaining sometime in the hot room this massecuite yielded 944 pounds of first sugar, polarizing 88°. The second masse cuite was left in the hot room at the end of the season.

(B) The second half of the sirup was treated with alcohol and boiled to grain. Fifty pounds sugar were added to form a nucleus after the sirup had been concentrated to proof. This sirup boiled very freely; the massecuite was short. This sirup worked so well that it was decided to boil the massecuite very stiff. The small vacuum pan is provided with a 14-inch foot valve and small coils, nevertheless it was almost impossible to discharge the massecuite. This sugar purged well, but slowly, in the centrifugal, while the massecuite was still hot, but soon began to dry very slowly. Had the boiling been discontinued a few minutes sooner the yield of sugar would have been larger and the polarization higher.

The yield of first massecuite was 2,334 pounds, and of first sugar 1,409 pounds. The sugar polarized 88.2°. The yield of sugar, per cent massecuite, was 60.3. Deducting the sugar added, we have a net weight of 1,359 pounds first sugar.

The molasses from the first sugar was boiled to string proof and left in the hot room until the end of the season. The weight of massecuite was 920 pounds and of second sugar 290 pounds. This sugar polarized 85.9°.

Résumé of yield.

UNDENDEBULE (COLLIER) CANE.

	A.	B.
Clean cane worked.....tons..	[1] 8.655	[1] 8.655
Topped cane worked.....do...	[1] 10.580	[1] 10.580
First masse cuite obtained.....pounds..	.....	[2] 2,284
First sugar obtained.....do....	944	[2] 1,359
Polarization of first sugar.....degrees..	88	88.2
First sugar reduced to 100° polarization.....pounds..	831	[2] 1,199
First sugar per ton clean cane.....do....	109.1	157
First sugar per ton topped cane.....do....	89.2	128.4
First sugar, 100° polarization, per ton clean cane.....do....	96	126.9
First sugar, 100° polarization, per ton topped cane.....do....	78.5	113.3
Second sugar obtained.....do....	.....	290
Polarization of second sugar.....degrees..	.....	85.9
Second sugar reduced to 100° polarization.....pounds..	.....	249
Second sugar per ton clean cane.....do....	.....	33.5
Second sugar per ton topped cane.....do....	.....	27.4
Second sugar, 100° polarization, per ton clean cane.....do....	.....	28.7
Second sugar, 100° polarization, per ton topped cane.....do....	.....	23.5
[1] Yield of first sugar per acre.....do....	1,084	1,560
[1] Yield of second sugar per acre.....do....	.....	333

[1] Correction made for samples and skimmings.
[2] Fifty pounds sugar deducted for sugar added to massecuite in the strike pan.

* See page 22.

EXPERIMENT NO. 8.—ORDINARY AND ALCOHOL PROCESSES.

Date: October 14, 1891.

Varieties and plats: No. 91 and No. 112; plats 38 and 41.

Gross cane (topped cane)	tons	23.375
Trash	do	4.080
Clean cane	do	19.295
Clean cane removed in samples	do	.150
Skimmings lost, calculated to clean cane	do	.584
Net clean cane worked	do	18.561
Mean weight of clean cane per cell	pounds	309
Trash, per cent topped cane		17.5

Juice analyses.

	Normal juice.	Diffusion juice.*
Degree Brix	18.40	12.4
Sucrose, per cent	12.80	.....
Glucose, do	.51	.....
Purity coefficient	69.40	.....
Glucose, per cent sucrose	3.98	.....

* Sample lost.

Exhausted chips.

Sucrose lost in exhausted chips, per cent cane, 0.62 (mean of eighteen analyses).

Sirups.

	A.	B.
Degree Brix	53.57	32.86
Sucrose, per cent	36.40	26.28
Glucose, do	2.17	1.37
Purity coefficient	67.90	79.80
Glucose, per cent sucrose	6.25	5.10

Filter-press cake..

Total solids	per cent	55.92
Sucrose	do	16.40
Alcohol (absolute)	do	10.88
Weight of filter press cake	pounds	396

The amount of sucrose lost in the press cake was 62.9 pounds and of alcohol 43.1 pounds.

Yield.

(A) This sirup was boiled to string proof. The yield of first massecuite was 3,162 pounds and of first sugar 1,373, polarizing 82.4°. The yield of sugar per cent masse cuite was 43.4. The molasses was boiled for second sugar, yielding 1,555 pounds of massecuite and 390 pounds second sugar.

(B) The second half of the sirup was treated by the alcohol process and boiled to grain. Fifty pounds sugar were added to the concentrated sirup in the pan to form a nucleus. The weight of the first massecuite was 2,534 pounds and of first sugar 1,352 pounds. This sugar polarized 93.6°. The yield of sugar per cent massecuite was 53.4. The second massecuite was not ready to centrifugal at the end of the season.

Résumé of yield.

CANE NO. 91 AND NO. 112.

		A.	B.
Clean cane, worked	tons	*9.28	*9.28
Topped cane, worked	do	*11.248	*11.248
First massecuite obtained	pounds	3,162	†2,484
First sugar obtained	do	1,373	†1,302
Polarization of first sugar	degrees	82.4	93.6
First sugar, reduced to 100° polarization	pounds	1,131	1,219
First sugar per ton, clean cane	do	147.9	140.3
First sugar per ton, topped cane	do	122.1	115.7
First sugar, 100° polarization per ton, clean cane	do	121.8	131.3
First sugar, 100‡ polarization per ton, topped cane	do	100.5	108.4
Second sugar obtained	do	390	.....
Second sugar per ton, clean cane	do	42	.....
Second sugar per ton, topped cane	do	34.6	.....
Yield of first sugar, per acre*	do	‡1,405	‡1,333
Yield of second sugar, per acre*	do	399	.....

* Corrected for samples and skimmings.
† Fifty pounds deducted for sugar added in strike pan.
‡ Note difference in the polarization of these sugars.

EXPERIMENT NO. 9.—ALCOHOL PROCESS ONLY.

Date: October 15, 1891.

Variety and plat: McLean; plat 11.

Gross cane (topped cane)	tons	8.655
Trash	do	1.565
Clean cane	do	7.090
Clean cane removed in samples	do	.045
Skimmings lost, calculated to clean cane	do	.504
Net clean cane worked	do	6.541
Mean weight of cane per cell	pounds	320
Trash, per cent topped cane		18.1

Juice analyses.

	Normal juice.	Diffusion juice.
Degree Brix	20	12.06
Sucrose, per cent	14.18	8.73
Glucose, per cent	.59	.37
Purity coefficient	70.90	72.40
Glucose, per cent sucrose	4.19	4.24

Exhausted chips.

Sucrose lost in exhausted chips, per cent cane 0.67 (mean of seven analyses).

*Sirups.**

	A.	B.
Degree Brix	57	33.02
Sucrose, per cent	42.48	26.70
Glucose, per cent	1.80	1.07
Purity coefficient	74.50	80.90
Glucose per cent sucrose	4.26	4.00

* A, Sirup before treatment by the alcohol process and B after treatment.

Filter-press cake.

Total solids	per cent..	52.91
Sucrose	do....	14.40
Alcohol (absolute)	do....	10.64

Weight of filter-press cake, pounds 284.

The loss of sucrose in the filter-press cake was 40.9 pounds (4.7 pounds per ton clean cane) and of alcohol 30.2 pounds.

Yield.

In this and the rest of the experiments, the alcohol process only was employed. The work by the ordinary process required so many sugar wagons and occasioned so much delay with the massecuites that it became necessary to abandon the plan of carrying on parallel experiments.

The sirup was boiled to grain and yielded 1,875 pounds of first massecuite and 965 pounds of first sugar, the latter polarizing 92.5°. The yield of sugar per cent massecuite was 51.5.

Sugar to the amount of 50 pounds was added as usual to the sirup in the pan.

The second massecuite was left in the hot room, as it was not ready for the centrifugal at the end of the season.

Résumé of yield.

McLEAN CANE.

Clean cane worked	tons..	* 8.625
Topped cane work	do...	* 10.568
First massecuite obtained	pounds..	†1,825
First sugar (92.5° polarization)	do....	†915
First sugar reduced to 100° polarization	do....	846
First sugar per ton of clean cane	do....	105.7
First sugar per ton of topped cane	do....	86.6
First sugar 100° polarization per ton of clean cane	do....	97.7
First sugar 100° polarization per ton of topped cane	do....	80
Yield of first sugar per acre *	do....	1,128

The McLean cane yielded a very rich juice, containing a low percentage of glucose. The loss of sugar after the concentration of the juice to sirup was very large and materially decreased the yield.

EXPERIMENT NO. 10.—ALCOHOL PROCESS ONLY.

Date: October 16, 1891.

Variety and plat: No. 161, plat 17.

Gross cane (topped cane)	tons..	11.790
Trash	do...	1.838
Clean cane	do...	9.952
Clean cane removed in the samples	do...	.075
Skimmings lost, calculated to clean cane		.402
Net clean cane worked	tons..	9.475
Mean weight of clean cane per cell	pounds..	309
Trash, per cent topped cane		15.6

* Corrected for samples and skimmings. † Fifty pounds deducted for sugar added.

Juice analyses.

	Normal juice.	Diffusion juice.
Degere Brix	17.20	9.94
Sucrose.....per cent..	11.29	7.18
Glucose.....do....	.63	.38
Purity coefficient	65.70	71.90
Glucose per cent sucrose	5.54	5.29

Exhausted chips.

Sucrose lost in the exhausted chips, per cent cane, 0.51 (mean of nine analyses.)

*Sirup.**

	A.	B.
Degree Brix	56.43	27.13
Sucrose.....per cent..	39.33	21.00
Glucose.....do...	2.50	1.21
Purity coefficient	69.70	76.60
Glucose, per cent sucrose	5.95	5.77

*A, before treatment by the alcohol process; B, after treatment.

Filter-press cake.

Total solids.....per cent..	48.71
Sucrose.....do....	20.40
Alcohol (absolute).....do....	13.58
Weight of filter-press cake.....pounds..	278

The loss of both sucrose and alcohol in the press cake was large. In experiments Nos. 10 and 12 there was not sufficient material to completely fill the filter press, hence the press-cake was soft and the loss of sugar and alcohol large. In experimental work of this class the filter press should be so constructed that either all or a part of the press can be used.

The loss of sucrose in the filter press cake amounted to 56.7 pounds and of alcohol 37.8 pounds.

Yield.

The sirup was boiled to grain. Fifty pounds sugar were added to form a nucleus upon which to build grain.

The yield of first massecuite was 2,193 pounds, and of first sugar 1,045 pounds. The yield of first sugar per cent massecuite was 47.7. The sugar polarized 91.4°.

The first massecuite was boiled too stiff and dried slowly in the centrifugal.

The molasses from the above was boiled for second sugar and yielded 255 pounds, polarizing 84.1°.

Résumé of yield.

CANE, VARIETY No. 161.

Clean cane worked	tons	*9.475
Topped cane worked	do	*11.786
First massecuite obtained	pounds	†2,143
First sugar obtained (91.4° polarization)	do	†995
First sugar reduced to 100° polarization	do	909
First sugar per ton, clean cane	do	105
First sugar per ton, topped cane	do	84.4
First sugar 100° polarization per ton, clean cane	do	96
First sugar 100° polarization per ton, topped cane	do	77
Second sugar obtained (84.1° polarization)	do	255
Second sugar reduced to 100° polarization	do	214.5
Second sugar per ton, clean cane	do	26.9
Second sugar per ton, topped cane	do	21.6
Second sugar 100° polarization per ton, clean cane	do	22.6
Second sugar 100° polarization per ton, topped cane	do	18.2
Yield of first and second sugar per acre*	do	1,356

EXPERIMENT NO. 11—ALCOHOL PROCESS ONLY.

Date: October 17, 1891.

Variety and plat: India and Orange; plat 8.

Gross cane (topped cane)	tons	11.480
Trash	do	1.240
Clean cane	do	10.240
Clean cane removed in samples	do	.075
Skimmings lost, calculated to clean cane	do	.619
Net clean cane worked	do	9.546
Mean weight of clean cane per cell	pounds	323
Trash, per cent topped cane		10.8

Juice analyses.

	Normal juice.	Diffusion juice.
Degree Brix	18.35	11.31
Sucrose, per cent	12.78	8.28
Glucose, do	.87	.58
Purity coefficient	69.60	73.20
Glucose, per cent sucrose	6.84	7.07

Exhausted chips.

Sucrose lost in exhausted chips, per cent cane, 0.60 (mean of eight analyses).

Sirups.[1]

	A.	B.
Degree Brix	54.50	28.00
Sucrose, per cent	38.70	22.07
Glucose, do	2.94	1.45
Purity coefficient	71.10	78.60
Glucose per cent sucrose	7.61	6.57

[1] A, sirup before alcohol treatment; B, after treatment.

* Corrected for samples and skimmings.

† Fifty pounds deducted for sugar added.

Filter-press cake.

Total solids	per cent	65.12
Sucrose	do	10.80
Alcohol (absolute)	do	9.48
Weight of filter press-cake	pounds	316
Sucrose lost in the filter press cake	do	34.1
Alcohol (absolute) lost in the filter press-cake	do	30

Yield.

The yield of first massecuite was 2,426 pounds and of first sugar 1,138 pounds, polarizing 92.1°. Forty pounds of sugar were added to form a nucleus upon which to build grain, but nevertheless the massecuite was sticky, and it was necessary to keep it in the hot room some time for the sugar to separate. The yield of first sugar per cent massecuite was 46.9.

The molasses from the above was boiled for second sugar and yielded 205 pounds, polarizing 87.8°.

The analytical data indicated that the India and orange cane was of excellent quality; hence it is probable that the vacuum-pan work is responsible for the difficulty in drying the sugar. A small pan is very sensitive to slight changes in the vacuum or to other irregularities, and even a good panman may fail to obtain a good result.

Résumé of yield.

INDIA AND ORANGE CANE.

Clean cane worked	tons	*9,546
Topped cane worked	do	*10,701
First massecuite obtained	pounds	†2,386
First sugar obtained (92.1° polarization)	do	†1,098
First sugar reduced to 100° polarization	do	1,011
First sugar per ton clean cane	do	115
First sugar per ton topped cane	do	102.6
First sugar 100° polarization per ton clean cane	do	105.9
First sugar 100° polarization per ton topped cane	do	94.5
Second sugar obtained (87.8° polarization)	do	205
Second sugar reduced to 100° polarization	do	180
Second sugar per ton clean cane	do	21.5
Second sugar per ton topped cane	do	19.2
Second sugar 100° polarization per ton clean cane	do	18.9
Second sugar 100° polarization per ton topped cane	do	16.9
Yield of first and second sugar per acre *	do	1,524

EXPERIMENTAL RUN NO. 12—ALCOHOL PROCESS ONLY.

Date: October 19, 1891.

Varieties and plats: Planters' Friend, No. 126, and Undendebule (Collier); plats 8, 38, and 41.

Gross cane (topped cane)	tons	11.840
Trash	do	1.820
Clean cane	do	10.020
Clean cane removed in samples	do	.075
Skimmings lost calculated to clean cane	do	.558
Net clean cane worked	do	9.387
Mean weight of clean cane per cell	pounds	338
Trash, per cent topped cane		15.4

* Corrected for samples and skimmings. † Forty pounds deducted for sugar added.

Juice analyses.

	Normal juice.	Diffusion juice.
Degree Brix	19.64	10.98
Sucrose, per cent	13.57	7.90
Glucose, do	.66	.38
Purity coefficient	69.20	71.90
Glucose per cent sucrose	4.85	4.81

Exhausted chips.

Sucrose lost in exhausted chips, per cent cane, 0.63 (mean of eight analyses).

Sirups.[1]

	A.	B.
Degree Brix	58.23	26.92
Sucrose, per cent	42.66	22.50
Glucose, do	1.73	1.19
Purity coefficient	73.20	83.60
Glucose per cent sucrose	4.02	5.29

[1] A, sirup before treatment with alcohol; B, sirup after treatment.

Filter-press cake.

Total solids	per cent	51.71
Sucrose	do	19.98
Alcohol (absolute)	do	14.12
Weight of filter press-cake	pounds	298
Sucrose lost in the filter press-cake	do	59.5
Alcohol (absolute) lost in the filter press-cake	do	49.1

Yield.

This sirup was boiled to string proof. Eighty pounds of sugar were added to the material in the vacuum pan, but the massecuite was very sticky and further attempts to build the grain were abandoned.

The yield of first massecuite was 2,260 pounds and of first sugar 1,003 pounds, polarizing 90.9°. The yield of the sugar per cent massecuite was 44.4.

The molasses from the above yielded 282 pounds of second sugar, polarizing 88.4°.

Résumé of yield.

PLANTERS FRIEND, NO. 126, AND UNDENDEBULE (COLLIER) CANE.

Clean cane worked	tons	*9.387
Topped cane worked	do	*11.096
First massecuite obtained	pounds	†2,180
First sugar obtained (90.9 polarization)	do	†923
First sugar reduced to 100° polarization		839
First sugar, per ton, clean cane	pounds	98.3
First sugar, per ton, topped cane	do	83.2
First sugar, 100° polarization per ton, clean cane	do	89.4
First sugar, 100° polarization per ton, topped cane	do	75.6
Second sugar obtained (88.4° polarization)	do	282

* Corrected for skimmings and samples. † Eighty pounds deducted for sugar added.

Second sugar reduced to 100° polarization	pounds.	249
Second sugar, per ton, clean cane	do	30
Second sugar, per ton, topped cane	do	25.4
Second sugar, 100° polarization per ton, clean cane	do	26.5
Second sugar, 100° polarization per ton, topped cane	do	22.5
Yield of first sugar per acre	do	1,107
Yield of second sugar per acre	do	338

The loss of sugar in this experiment after the juice had reached the sirup stage, was very large. Notwithstanding an apparently extra good sirup the massecuite was unfit to centrifugal on leaving the vacuum pan.

EXPERIMENT NO. 13.

Date: October 20, 1891.

Variety and plat: Ubehlana; plat 41.

Gross cane (topped cane)	tons	11.820
Trash	do	1.670
Clean cane	do	10.150
Clean cane removed in samples	do	.075
Skimmings lost calculated to clean cane	do	.536
Net clean cane worked	do	9.539
Mean weight of clean cane per cell	pounds.	325
Trash, per cent topped cane		14.1

Juice analyses.

	Normal juice.	Diffusion juice.
Degree Brix	16.00	10.15
Sucrose, per cent	10.01	6.68
Glucose, do	1.30	.90
Purity coefficient	62.60	65.8
Glucose per cent sucrose	13.05	13.45

Exhausted chips.

Sucrose lost in exhausted chips, per cent cane, 0.42 (mean of nine analyses).

*Sirup.**

Degree Brix		25.45
Sucrose	per cent	18.81
Glucose	do	2.61
Purity coefficient		73.90
Glucose per cent sucrose		13.85

Filter-press cake.

Total solids	per cent	71.23
Sucrose	do	9.90
Alcohol (absolute)		6.05
Weight of filter press-cake	pounds	306
Sucrose lost in the filter press-cake	do	30.3
Alcohol lost in the filter press-cake	do	18.5

* Sirup after treatment with alcohol.

Yield.

The sirup in this experiment was boiled to string proof, no attempt being made to form grain. The massecuite weighed 2,168 pounds and yielded 696 pounds of first sugar polarizing 89.4°. The yield of sugar per cent massecuite was 32.1.

The second sugar was left in the wagons at the end of the season.

Résumé of yield.

UBEHLANA CANE.

Clean cane worked	tons..	*9.539
Topped cane worked	do...	*11.105
First masse cuite obtained	pounds..	2,168
First sugar obtained (89.4° polarization)	do....	696
First sugar reduced to 100° polarization	do....	622
First sugar per ton clean cane	do....	72.9
First sugar per ton topped cane	do....	62.7
First sugar 100° polarization per ton clean cane	do....	65.2
First sugar 400° polarization per ton topped cane	do....	56.1
Yield of sugar per acre	do....	806

The Ubehlana cane contained very little sugar and the juice was of low purity.

GENERAL REMARKS ON THE SUGAR-HOUSE WORK.

The principal losses of sugar were at the still and by entrainment in the vacuum pan. Both these losses were such that they could not be avoided with the machinery as now constructed. In some instances these losses were very heavy, amounting to 40 pounds or more of sucrose per ton of cane. In working on a large scale such losses would either be avoided or reduced to a small number of pounds.

The yield of sugar in the greater number of the preceding experiments by both methods of working was largely in excess of that obtained by the sorghum sugar manufacturers. This was partly due to the facilities for working the cane very promptly after cutting. The work in the sugar-house was prompt, rapid, and regular, all three being conditions essential to a large yield. In two experiments, viz, Nos. 11 and 12, the cane, while rich in sugar, produced a massecuite which was difficult to centrifugal. Certain varieties of cane furnish juices that are much more manageable than others and notwithstanding a lower sucrose content will yield a larger proportion of sugar.

It is doubtful whether the cane employed in experiments Nos. 11 and 12 would have yielded a massecuite by the ordinary process, that could have been promptly centrifugaled.

The most prominent advantage of the alcohol over the ordinary process is that it yields a first sugar of good color and of high polarization. With the exception of two or three strikes of sugar which were left in wagons a short time, the average polarization of the first sugars (unwashed) by the alcohol process was 92.6° and of first sugars by the ordinary process 84.7°.

* Corrected for samples and skimmings.

The refiners discriminate against sorghum sugar as manufactured by the ordinary process, and pay per degree of polarization a smaller price for the sorghum than for the cane product.

The objection of the refiners to sorghum sugar as manufactured by the ordinary process can not exist with that obtained by the alcohol process, since in the latter the objectionable gums are removed.

For the sake of a comparison of the two sugars, in the calculations given below, no account is taken of this discrimination. The prices are based on the New York quotations as published in the Louisiana Planter and Sugar Manufacturer, issue of March 5, 1892. The deduction per one-tenth degree per 100 pounds of sugar is taken at one-sixteenth cent.

Value of sugars on a refining basis.

A. Price of "fair refining," 89° test, $3 per 100 pounds.

89.0° = test of market.
84.7° = average test of first sugar made, ordinary process.

4.3° = difference in test.

$\therefore 43 \times \frac{1}{16} = \$0.027$, deduction per 100 pounds sugar on account of lower polarization.

$\$3.006 - 0.027 = \$2.973$, net price of sugar, per 100 pounds.

Sucrose value = $3.51 per 100 pounds.

B. Price of "centrifugals" 96° test, $3.406 per 100 pounds.

96.0° = test of market.
92.6° = average test of first sugar, alcohol process.

3.4° = difference in test.

$\therefore 34 \times \frac{1}{16} = \$0.021$, deduction per 100 pounds sugar on account of lower polarization.

$\$3.406 - 0.021 = \$3.385$, net price of the sugar per 100 pounds.

Sucrose value = $3.655 per 100 pounds.

From the above calculation it may be seen that the planter would receive $0.145 per 100 pounds sucrose in his first sugar more money if he employs the alcohol instead of the ordinary process. In addition to this he is enabled to place his product on the market promptly, and to sell a sugar which can compete under favorable conditions with that manufactured from cane. This is a decided gain over the methods now in use.

In these calculations no account is taken of the bounty on sugars. The unwashed sorghum sugars by the ordinary process would probably polarize below 90° and receive the lower rate of bounty. Grain sugars by the alcohol process will polarize above 90° as a rule and receive the higher rate of bounty.

Sirups bleached with sulphurous acid and then treated by the alcohol method will yield an excellent grade of yellow clarified sugar.

Further experiments are necessary to determine to what extent the increased fuel consumption and the loss of sugar in the filter-press cake would offset the gains by the alcohol method.

By means of filter presses designed especially for the purpose this loss of sugar can be reduced to a very small amount. Improvements in the distilling process would materially diminish the dilution of the sirups and the consequent increased fuel consumption. The increase in fuel consumption can probably be reduced to but little more than that required in the recovery of the alcohol.

EXPERIMENTS IN THE TREATMENT OF MOLASSES.

Two sets of experiments were made in the treatment of molasses from other sugar houses.

In these experiments the molasses was diluted to 54° Brix and then treated with an equal volume of 90 per cent alcohol. The alcohol-molasses mixture was filter pressed and the alcohol recovered by distillation.

Unfortunately, in the case of the molasses from the Medicine Lodge factory, the analytical data are incomplete, hence the losses can only be traced indirectly.

MOLASSES FROM FACTORY OF MEDICINE LODGE SUGAR COMPANY.

This molasses was obtained October 6 directly from the centrifugals, which at the time were drying first sugar.

Analysis of molasses after treatment.

Degree Brix		28.09
Sucrose	per cent	16.10
Glucose	do	2.77
Purity coefficient		57.3
Glucose, per cent sucrose		17.2

Filter-press cake.

Total solids	per cent	51.19
Sucrose	do	9.60
Alcohol (absolute)	do	15.88
Weight of filter-press cake	pounds	402
Sucrose lost in filter-press cake	do	38.6
Alcohol lost in filter-press cake	do	63.8

Yield.

The purified molasses was boiled to string proof and yielded 2,083 pounds of massecuite and 888 pounds of sugar polarizing 80°. The yield of sugar per cent massecuite was 42.6.

RÉSUMÉ OF YIELD—MEDICINE LODGE MOLASSES.

Molasses taken	pounds	2,962
Molasses taken	gallons	250
Massecuite obtained	pounds	2,083
Sugar obtained (80° polarization)	do	888
Sugar obtained reduced to 100° polarization	do	710
Sugar per gallon of molasses	do	3.55
Sugar reduced to 100° polarization per gallon of molasses	do	2.84

The loss of sucrose, aside from that in the filter press cake, was approximately, 115 pounds. On a basis of the yield obtained from the massecuite this corresponds to a loss of 83 pounds of sugar. Had this loss not occurred the yield would have been 971 pounds of sugar, or 3.88 pounds per gallon of molasses.

MOLASSES FROM PARKINSON SUGAR WORKS, FORT SCOTT.

This molasses was treated in the same manner as that obtained from the Medicine Lodge Sugar Company.

*Analysis of molasses.**

	A.	B.
†Degree Brix (original)	85.83	.....
†Degree Brix (after dilution)	73.37	30.43
Sucrose ..... per cent	26.64	12.70
Glucose ..... do	17.10	8.45
Purity coefficient	37.30	41.70
Glucose per cent sucrose	64.18	66.50

* A, before treatment with alcohol; B, after treatment.
† Analysis made after dilution.

Filter-press cake.

Sucrose ..... per cent	...	13.6
Alcohol (absolute) ..... do	.....	7.1
Weight ..... pounds	..	668
Sucrose lost ..... do	....	91
Alcohol (absolute) lost ..... do	....	47.4

Yield.

The purified molasses yielded 2,380 pounds of massecuite from which 554 pounds of sugar were obtained. This sugar polarized 84.5°. The resulting molasses had a purity of 36 and contained 89 per cent glucose sucrose.

Résumé of yield.

MOLASSES FROM FORT SCOTT.

Weight of molasses taken ..... pounds	..	3,064
Volume of molasses ..... gallons	..	253
Massecuite obtained ..... pounds	..	2,380
Sugar obtained (84.5° polarization) ..... do	....	554
Sugar obtained reduced to 100° polarization ..... do	....	468
Sugar obtained per gallon of molasses ..... do	....	2.19
Sugar obtained reduced to 100° polarization per gallon of molasses ..... pounds	..	1.85

REMARKS ON THE YIELD OF SUGAR FROM MOLASSES TREATED BY THE ALCOHOL PROCESS.

The yield of sugar in the second molasses experiment was very satisfactory. The loss at the still and the entrainment were very small, not exceeding 13 pounds of sucrose.

The original molasses was of very low purity and by the ordinary process would have yielded a massecuite that could not be successfully centrifugaled. Molasses of this grade would be considered of very low purity, even in a Louisiana cane-sugar house. It is very probable that the yield of sugar would have been much larger and the purity correspondingly lower could this massecuite have been left in the wagons until late in the summer.

The advantage of the alcohol treatment is more apparent in the case of the Fort Scott molasses than in that from Medicine Lodge. In the first case the molasses would have yielded about 2½ pounds per gallon of sugar polarizing less than 80°. This assumption is based on the yields obtained from molasses of similar grades, by the ordinary process, as given in this report. The Fort Scott molasses in question would not, under any circumstances, repay further efforts to obtain sugar by the ordinary method of treatment.

NOTES ON DAILY WORKING OF EXPERIMENTAL FACTORY.

A diary of the daily working of the experimental factory for the whole season would prove of little benefit, but an illustration of the method of conducting the work embracing the first week of actual manufacture may not be found out of place.

FOR WEEK COMMENCING MONDAY, SEPTEMBER 28.

Monday was devoted to making certain alterations in the house, connecting the strike pan with the live steam and other necessary adjustments. Monday afternoon started to cutting Colman cane, and six loads were brought in. At 7 o'clock Tuesday morning the cutters were started and ran regularly during the day, stopping an hour in the afternoon on account of the failure of the triple-effect to keep the juice evaporated. This failure was due to the experience in management of the pans rather than to any lack of capacity.

The two acres, approximately, of Coleman cane, were finished about half-past 10, and the sirup was boiled out by 2 o'clock Wednesday morning. More trouble was experienced with the pump taking the sirup from the triple effect. It often refused to work and quite a quantity of sirup was lost in adjusting it. The sirup made, however, was of a fair quality and showed considerable inversion in the triple effect, as shown by the increase in the glucose ration, shown in the analytical data.

The sirup was collected in one tank and thoroughly mixed and then equally divided into two portions.

On Wednesday the men were set to cleaning up, and the divided sirup was boiled, the first part of it without treatment with alcohol. It was boiled to grain; the grain being very fine, it was placed in the hot-room until Saturday. In the afternoon of Wednesday the cutters were placed to work on variety No. 160, and eight loads of this variety were delivered.

Wednesday night a severe wind and rain storm struck us, which raged during the whole day Thursday. Not being able to get in the remainder of variety No. 160, the part of it which was in was not worked, in the expectation of a clear day following, when the whole of the plot could be worked together. On Friday, however, the sky was still overcast, some showers followed during the day, and the field was so soft and mushy that it was impracticable to go on it with wagons. The cutting of the remaining portion of variety No. 160 was therefore postponed until Saturday. During Friday the second half of the sirup from the Colman cane was treated with

alcohol and run through the filter presses. Owing to the large amount of mud that was precipitated by the alcohol and the small space for cake in the twin presses it was found that they soon filled.

This caused great delay in filtering and a considerable loss of sirup, both in press cakes and unavoidable wastage. In order not to stop the strike pan the last portions of the sirup were drawn into the still without filtering, and thus a large quantity of mud was mixed with the sirup, but not enough to appreciably alter its quality.

The still was operated by opening the alcohol chambers above and allowing the alcohol to pass through the goose without condensation. This delivered an alcohol of about 130° to 140° proof. This was afterward concentrated in the still in the usual way to approximately 190° proof. It was found that there was no loss of alcohol in the sirup, the losses being due to the unavoidable loss in starting and stopping the still, and this loss would be wholly obviated in regular and continuous running. The sirup, however, is considerably diluted in passing through the still-its Brix being reduced from 53° to 36°. This can be avoided by a different arrangement of the still, allowing the alcohol of about proof strength to be obtained at first run.

During Friday the half of the alcohol-treated sirup from the Coleman cane was boiled, making beautiful grain and very stiff masse cuite which broke off in chunks as it ran from the pan. This masse cuite was sent directly to the centrifugal and yielded 59.3 per cent. of sugar on its weight. The first strike of it yielded about 56 per cent, and the second strike which was boiled much stiffer, nearly 64 per cent. The first strike of masse cuite was of a Brix of 91.0 and the second strike was still more dense. The masse cuite worked beautifully in the machine, the machine taking full charges, and yielded from 150 to 170 pounds of dry sugar per charge. The time of running for each charge was from 3 to 5 minutes only. The sugar was of a fine texture, of a beautiful yellow color, and of a most excellent quality. No wash of any kind was used in the machine. The yield of masse cuite was 2,242 pounds and the yield of dry sugar 1,330.

The total weight of cane delivered, the cane being topped in the field, was 4.489 pounds and the area on which the cane was grown was 1.879 acres. The weight of trash weighed back after passing the fans was 8,860 pounds, and the weight of cleaned cane 36,230. One cell of juice was lost on account of a failure to close cell door, equivalent to 330 pounds of chips. Eighteen buckets of chips were taken for analysis, weighing 270 pounds. Total weight of chips to be deducted, 600 pounds. The skimmings which were rejected at the end amounted to 89 gallons, equivalent to 2.1 cells of chips, viz, 690 pounds. The juice from the total amount of cleaned cane entering the pans was therefore from 34,940 pounds of cane. One-half of this was boiled to string and the other half to grain.

The other half of the sirup, representing 8.79 tons of cleaned cane, was treated with alcohol. There was lost in the press cake and by the necessity of opening the sirup pump several times an amount of sirup equal to .29 ton of cleaned chips, making the total weight of cane represented in the strike of massecuite obtained, 8.5 tons.

The expectation of fair weather for Saturday, in order to enable us to finish variety No. 160, was disappointed.

During Friday night and Saturday morning a severe northwest rain storm set in, with high winds and rapidly falling temperature, making it impossible for the men to enter the field. It was, therefore, determined to work that part of plot 160 which had been lying on the yard since Wednesday, inasmuch as it would not be fit for anything if held until the rest of it could be reached. Accordingly, the cutters were started Saturday morning, and the amount of cane of variety No. 160 lying on the yard was run through the mill.

During the whole of the week vexatious delays occurred from the failure of pumps in various parts of the house to work. The whole pump system here is faulty and

bids fair to give us continual and disastrous delays. We have also found a very serious fault in the strike pan. It was noticed that water was continually entering the pan during the boiling of it. It was first thought that this was due to a leaky coil, but further investigation showed that it was a reflux from the condenser. This flow of water into the pan will necessitate the taking out of the leg pipe or the condenser, or both, to investigate the cause of the accident.

The Thoen trap, connecting with the pan, does not work, and great trouble is experienced in keeping a proper adjustment of the escape from the coils. Various leaks occurred in different parts of the house during the week, producing an untidy appearance of the floors and showing carelessness in the erection of the apparatus. Nearly all of the fittings and pumps which have been taken out show débris of various kinds which has been left in the pipes and tanks, and this débris has caused a great amount of delay.

CULTURE WORK WITH SORGHUM.

AT STERLING.

The experiments in establishing new varieties of sorghum, improving old ones, and developing crosses were continued at Sterling during the season of 1891. The general line of the work was that pursued in former years and the detailed results will be found in the report of Mr. A. A. Denton, the efficient superintendent of the station, which will follow.

In regard to the character of this work it may be said, in answer to any possible criticism, that although much of it appears to be unnecessary it is difficult to see what part of it can be safely omitted. In the great number of different varieties of sorghum which have been tried almost everyone has presented some quality which seemed valuable, and it seems unwise to wholly reject any variety as long as there is any possibility of its developing any quality which may prove of permanent benefit to the industry. Nevertheless, it may be said that, after four years' careful work, it is possible at the present time to select some five or six varieties, which on the whole have shown the very best qualities for sugar-making purposes. As the result of this work the old established varieties which heretofore have been used for this purpose are giving up the field to the new and improved varieties. A few years ago the only varieties of sorghum that were used for sugar-making purposes were the Early Amber and the Early Orange. It may be said at the present time that the day of usefulness of these two varieties is passed, but they have not been cultivated in vain. The trouble with the Early Amber has always been the small size of the stalk, its delicacy, the ease with which it would retrograde, and the rapidity with which, after reaching the period of maturity, it would pass into a condition unfit for manufacture. Its chief merit was its early maturity and the fact that in certain conditions it would furnish a juice which, at maturity, contained a fairly good content of sugar. On the other hand, the Early Orange was a sturdy variety, yielding well, and persistent in its type. It has, however, from the first been characterized

by a high content of reducing sugar or glucose, which rendered it essentially a molasses-producing plant rather than a sugar-producing one. The idea of developing a new variety by the crossing of these two old and standard varieties has been fully carried out during the four years of experimental work, and the result has been the establishment of a new variety which in all of its characteristics and sugar-producing qualities has proved in practice to be the very best of all the varieties of sorghum. It may be said, therefore, definitely, that this cross has been fully established by four years of selection and will produce now a perfectly uniform plat of sorghum, having high sugar-producing qualities. In the plat of this variety which was grown at Medicine Lodge during the past year it was difficult to distinguish, in looking over the field, more than one size of stalk or more than one degree of maturity.

It will be seen at once that one of the chief points to be kept in view in the development of a variety is to have it uniform, so that when it reaches the proper period for manufacturing the whole of it may be ready; otherwise we would have a plat of cane some of which was very ripe and already in the retrogressive stage, and part of which was in the proper degree of maturity for manufacturing, and the rest of it not yet mature. The faulty character of the juice of such a plat of cane can be easily understood without further illustration. If the work of the station had never resulted in anything more than the establishment of this variety it would have paid a thousand-fold the cost of its conduct.

While this is the most striking illustration of the good effects of the station work, it is by no means the only one. During the season of 1888 a package of seed was received from Dr. Peter Collier, director of the New York Agricultural Experiment Station at Geneva, from some varieties with which he had experimented during the time he held the office of chemist of the Agricultural Department. This variety has proved to be one of the very best for the semiarid regions of Kansas and adjacent States. In recognition of the eminent service which Dr. Collier has rendered the sorghum-sugar industry I have directed that the better one of the varieties in this package of seed should be named Collier cane. The chief characteristics of this variety of cane are high content of sugar, low content of reducing sugar, great hardiness, and an especially light seed top, which enables the canes, although rather slender, to withstand the severe gales of Kansas. In the plat grown at Medicine Lodge during the past season for sugar-making purposes it was also found to resist longer than any other variety the action of the frost. Late in October, when all the other varieties in the expermental plat had been frost bitten, a great number of the leaves of the Collier variety were still green and vigorous. Its working in the experimental factory was only inferior to the Colman cane, and as a practical sugar-maker this variety must be ranked next to the Colman cane.

The good qualities of the McLean variety received two years ago from Australia from Hon. Peter McLean, through the office of the Secretary of State, have also been shown during the two years of growth. While this variety, so far as chemical analysis is concerned, leads all the others during the past two years, it has not shown as good results in the factory as the Colman or Collier varieties. It is nevertheless one of the most promising varieties and deserves the most careful practical tests.

It is a matter of regret to me that I am able to give no greater personal attention to this interesting work than an occasional visit to the station, but this regret is tempered by the knowledge that the work has been intrusted to such able hands. It requires not only intelligence and enthusiasm to conduct work of this kind, but an untiring industry and an unruffled patience. I think it will be granted by anyone who has had any personal knowledge of the work at the station that these qualities have been eminently manifested in the details of its work.

In regard to the lines of the experimental work, slight changes will be made from time to time as experience may dictate. Heretofore the work has been conducted solely by analytical data; hereafter it is hoped that the element of practical work in the factory may enter into the solution of the problem. Not only is it important that varieties of cane shall be produced with high sugar content, low glucose, and high purity, but also that the varieties shall be sturdy, able to endure the vicissitudes of the climate in which they are grown, to withstand the constant and severe winds of the central southwestern part of our country, to endure drought and rapid changes of temperature, to mature before killing frosts, and to be able to maintain their sugar content for many weeks after the growing period has ceased. The solution of many of these problems can not depend upon laboratory experience alone; actual experience in the factory must be the final test to which all these varieties are to be subjected. It is evident at once that such tests can not properly be made in a factory making sugar on a commercial scale. The only proper place for the solution of such problems is in the experimental factory, such as was established during the past season at Medicine Lodge. Referring further to the lines on which the work should be continued, I have in view not only the extension of the work on the general line on which it has been carried on in Sterling, but also its development in certain special lines looking more directly to its practical use.

The time has now come when it is possible to furnish intending growers of sorghum for manufacturing purposes varieties of seed of satifactory character and developed from scientific selections extending over a period of years. The growers of such seed, however, must not be astonished to find among them some reversions to the primitive forms. Especially is this true in the case of crosses, where many years of careful selection will have to ensue before an absolute uniformity of

standard can be secured. In most crosses at the present time there would be found many reversions to parent types, so that the appearance of "sports" or of canes differing from the general type planted from such seeds must not occasion astonishment.

For the first time, however, the Department has been able to offer during the present season to intending growers for commercial purposes a quantity of seed sufficient to plant their fields, grown from cane developed from four years of careful selection, and containing, as we believe, the germ of new life for the sorghum industry. With ordinary seeds grown in the ordinary way the sorghum factories have almost been able to be profitable. In fact, during the past year some of them have made a profit. With seed which it is believed will produce at least from 20 to 30 pounds more sugar per ton it must be possible for such factories to enter upon an era of commercial prosperity.

The great object of seed selection and culture work, after all, is to secure a large yield of merchantable sugar in the factory. That method of selection and culture which will develop the variety best suited to this purpose is the one that will stand the test of experience and result in the greatest good. It is believed that the lines upon which the work has been carried on during the past four years will need very little modification to reach these results. The most speedy way to accomplish them is to combine the experimental factory with the experimental field work. It is proposed, therefore, in another season to carry them on together, so that the work of seed selection and testing of the varieties in the experimental factory may be carried on side by side. In this way not only will a greater economy be secured in conducting the work, but also a greater efficiency.

The magnitude of the experimental work carried on in Sterling may be realized by reference to the number of analyses executed. The whole number of tests for the season amounted to over 100,000; this includes the examination of single canes and the general samples. In order to obtain the average sugar content of any given plat a large portion of it was run through a two-horse mill and the juice issuing therefrom subjected to analysis. The total number of polarizations made was 29,306 and the highest number of polarizations made in any one day 1,520. Over 100,000 stalks were put through the mill separately, and the juice therefrom examined with the saccharometer. The total number of single canes examined by polarization was 26,634; of these 13,946 contained 15 per cent and over of sucrose in their juice, and 12,688 failed to reach the standard of 15 per cent and were rejected. Of the 13,946 samples which reached the standard, 5,905 contained a content of sucrose between 15 and 16 per cent; 5,296 from 16 to 17 per cent; 2,550 from 17 to 18 per cent; 1,727 from 18 to 19 per cent, and 23 contained over 19 per cent.

AT MANHATTAN.

It will be proper here to give a brief account, also, of experiments similar to the above made at the Kansas State Agricultural College at Manhattan, under the able direction of Prof. G. H. Failyer. The lines of work were practically the same as those indicated for the station at Sterling. The State station, however, could not be expected to enter into the work on so extensive a scale as the Department does at Sterling, inasmuch as a large portion of the energies of the State station must necessarily be directed toward the development of other forms of agriculture.

The varieties which were tested at the station at Manhattan were thirty in number, including all the leading varieties grown at Sterling. One thousand three hundred single stalks were examined and sixty-six polarizations made. The results of the experiments at Manhattan station showed that the Collier cane was the richest in cane sugar and the lowest in reducing sugar. The highest percentages of sugar observed in the juices were 18.95 in Collier, 18.25 in Colman, and 18.59 in Kansas Orange.

Experiments were also tried with fertilizers, but no deductions can be drawn with certainty from the first year's work, with the exception of the fact that Chile saltpeter seemed to increase the quantity of sucrose in the juice. The season of 1891 is said to have been the most favorable for sorghum of any in the past eight years, the growing part of the season being well supplied with rain and followed by a rather dry fall favorable to the maturation of a sorghum rich in cane sugar. The quality of sorghum grown at the station in previous years has never approached the excellence attained by the crop of 1891. Part of this improvement may be, and probably is, due to seed selection; but the propitious season is credited with most of the increase in sugar content.

AT PATTERSON, LA.

Interesting and valuable experiments in sorghum culture were also made by Mr. Wibray J. Thompson, on Mr. Daniel Thompson's Calumet plantation, Patterson, La., during the past season, being a continuation of the same line of experiments carried on by him in previous years. An effort was made even more earnestly than in former years in the selection of seed for propagation from canes of high value, and little or no time was given to investigating canes which did not possess an important bearing upon the main work of improving the varieties. Such matters as tonnage, proper fertilizers, and the like are certainly of the highest importance in their influence on the final success or failure of the plant as an economic source of sugar. It is primarily necessary to secure a plant which shall assure reasonably good returns for the expense of its proper cultivation. Mr. Thompson has kindly placed the data of the season's work at the disposal of the Department, and it will be found as a part of this report.

It is a matter of congratulation that the work which the Department has instituted has been found of such value as to incite private enterprise to undertake similar experiments in a soil and climate entirely different from those which form the environments of the Department's work in Kansas. The great object of Mr. Thompson's endeavors is, if possible, to evolve a sugar-producing plant which may supplement the sugar season with sugar cane in Louisiana. As is well known, by reason of the severity of the climate in Louisiana, the sugar season is of limited duration. Sixty days at most are all that can be counted for general work with sugar cane without recourse to windrowing or some other expedient for preserving the cane from the action of the frost. As a result of this inclemency of the weather, the expensive machinery for sugar-making must lie idle for eight or nine months of the year. It has been Mr. Thompson's idea that if a sugar plant could be produced which would enable the machinery of the factory to be set in operation, say in September instead of the 1st of November, two months could be added to the manufacturing season, and consequently the profit of sugar manufacturing increased to that degree. Mr. Thompson has therefore carried on at his own expense extensive cultural experiments in sorghum on the same general lines indicated in the Sterling work for the past three years with the most gratifying results, as will be seen from his report which follows.

The general results of Mr. Thompson's experiments have shown that so far as the climate and soil of Louisiana are concerned there are six varieties which give promise of excellent results. Arranged in the order of their excellence as determined by his experiments these varieties are: Colman, Collier, Planter's Friend, Link's Hybrid, Early Orange, and Ubehlana. These results are very similar to those obtained by the Department in Kansas, with the exception of the variety Ubehlana, which seems to be very inferior to the others for sugar-making purposes in Kansas. From an inspection of the tables it will be seen that the minimum percentage of sucrose in the juice of the best single canes of the different varieties is of the most satisfactory quantity, far exceeding that reached by the sugar cane of the same locality. It must not be inferred from this, however, that the sorghum is superior to the sugar cane as a sugar-producing plant. The very fact that Mr. Thompson does not use sorghum as a source of sugar shows that he is yet far from being convinced that it can take the place of sugar cane as a profitable source of sugar in Louisiana. It is only when the sorghum cane is manufactured by the process of diffusion and the sirup subsequently treated with alcohol, that the yield per ton of merchantable sugar can be expected to approach or exceed that of the sugar cane of Louisiana.

AT MEDICINE LODGE.

The cultural work at Medicine Lodge was not directed toward improvement by seed selection, but to the study of general agricultural

methods and the collection of data relating to tonnage, sugar content, and seed yield. It is believed that these matters, as determined by the work, will prove of great practical utility.

For the purpose of testing agricultural methods in the production of sorghum cane a field of 39½ acres, lying 2 miles west of Medicine Lodge, was leased from Miller & Benedict.

The field has a gentle slope to the south and is quite level. The soil is a deep rich loam of great fertility. The land was properly prepared by deep plowing and subsoiling and was divided by the surveyor into thirty-two plots in conformity with the appended plan. The description of the planting and of the agricultural work follows:

NOTES IN REGARD TO PLANTING.

The experimental field at Medicine Lodge was divided into plats and blocks as indicated in Fig. 4. Each plat of the shorter ones was 40 feet wide and 1,000 feet long. Each plat of the longer ones was 40 feet wide and 1,089 feet long, containing exactly 1 acre. Each block contains two plats, save block No. 5, which has three. The blocks are separated by alleys 10 feet wide.

Block No. 1.

This block was planted as follows, on the 28th of April: Four rows of variety No. 131 from pedigreed seed heads from Sterling, Kans., of the following numbers and mean composition: Seed head numbers, 8972, 8992, 8950, 6687, 8948, 8937, 8201, 10051, 6683, 8971, 8993, 10008, 8977, 8945, 8960, 8173, 8978, 8333, 8331, 8951, 9011, 6702. Mean Brix, 20.33. Mean sucrose, 16.80 per cent. Mean purity, 83.79. Next one row of Folger's Early, from a seed head from Sterling, Kans., with no pedigree. One row of Early Amber, planted with seed head No. 1233; cut August 21, 1890; Brix, 21.7; sucrose, 16.6 per cent; purity, 76.50. One row of No. 161, planted from seed head No. 9002, from Sterling, Kans.; Brix, 20.18; sucrose, 16.96 per cent; purity, 84.10; cut September 11, 1890. Next, one row of Colman without pedigree, and followed by two rows of Black African from bulk seed. One row of Link's Hybrid without pedigree; one row of Folger's Early without pedigree; one row No. 161 without pedigree; seed from Sterling, Kans.

Block No. 2.

This block was all deep plowed and subsoiled and planted with a drill on the 28th of April. The whole plat was planted with Black African seed in bulk, grown on the experimental station at Sterling, Kans.

Block No. 3.

This block was all deep-plowed and subsoiled. Beginning on the south side of the block there were planted by hand on the 28th of April eight rows of Early Orange from pedigreed seed, from Sterling, Kans., of the following numbers and mean composition: Seed-head numbers, 8775, 8723, 8804, 8713, 9248, 9280, 9285, 9287, 9292, 9295, 9296, 9301, 9302, 9340, 9381, 9392, 9525, 9531. Mean Brix, 20.27. Mean sucrose, 15.6 per cent. Mean purity, 76.98.

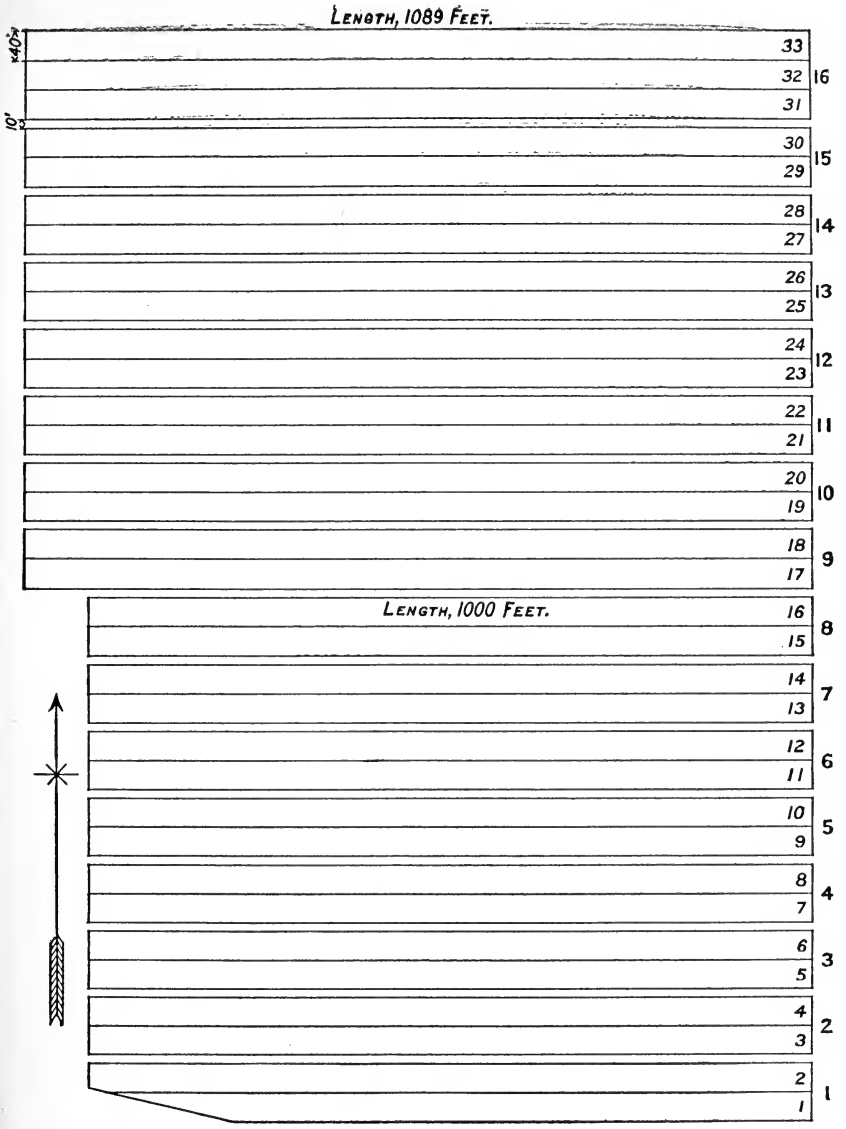

FIG. 4.—United States Department of Agriculture experimental field for sorghum cane, Medicine Lodge, Kans.

This was followed with seven rows of Medicine Lodge Orange, planted on the 27th of April from seed heads grown by the Medicine Lodge Company, of the following description: Mean Brix, 21.7; mean sucrose, 17.7 per cent; mean purity, 80.6. These rows were in the center of plat No. 8. Next came two rows of Collier beginning on the north side of block No. 8 from pedigreed seed heads grown at Sterling, Kans., of the following numbers and mean composition: Seed-head numbers, 8841, 8243, 8865, 8873, 9129, 9132, 9133, 9142, 9148, 9157, 9160, 9161, 9163, 9168, 9171, 9174, 9176, 9182, 9188, 9192, 9196, 9202, 9203, 9207, 9208; mean Brix, 21.25; mean sucrose, 17.62 per cent; mean purity, 82.31; followed by two rows of Undendebule No. 1 from pedigreed seed heads from Sterling, Kans., of the following numbers and mean composition: Seed-head numbers, 8853, 8857, 9101, 9122, 9134, 9141, 9144, 9151, 9153, 9164, 9173, 9180, 9725, 9945, 9962, 10501; mean Brix, 20.73; mean sucrose, 16.75; mean purity, 80.8.

Block No. 4.

This block was deep-plowed and subsoiled. Beginning on the south side there was planted on the 25th of April with a hand drill six rows Orange and Amber or Colman cane from pedigreed seed heads from Sterling, Kans., of the following numbers and mean composition: Seed-head numbers, 7753, 7760, 7766, 7771, 8271, 8280, 8296, 8304, 8362, 8369, 8385, 8564, 8620, 8657, 10339, 10653; mean Brix, 21.12; mean sucrose, 17.17 per cent; mean purity, 81.29; followed by Colman cane planted with a drill on the 25th of April from seed heads grown from Sterling, Kans.; followed by six rows Orange and Amber cross (Colman cane) from pedigreed seed heads from Sterling, Kans., of the following numbers and mean composition: Seed-head numbers, 8269, 8274, 8281, 8284, 8289, 8302, 8340, 8350, 8588, 8629, 8648, 8691; mean Brix, 20.07; mean sucrose, 16.48 per cent; mean purity, 82.11.

Block No. 5.

This block was deep-plowed and subsoiled and planted with a horse drill on the 30th of April with variety No. 161, bulk seed from Sterling, Kans.

Block No. 6.

This block was deep plowed, subsoiled, and planted on the 30th of April with Colman cane, with a horse drill. The seed was from Sterling, Kans.

Block No. 7.

This block was deep-plowed and subsoiled. It was all planted in variety No. 160, with a horse drill, on the 1st of May.

Block No. 8.

This block was deep-plowed, subsoiled, and planted with variety No. 160, with a horse drill, on the 1st of May.

Block No. 9.

The whole of this block was planted with Link's Hybrid on the 24th of April. Plat 33 was planted with a planter, and plat 31 with a hand drill, with pedigreed seed from Sterling Kans., of the following numbers and mean description: Seed-head numbers, 1994, 10422, 12005, 11997, 12002, 11993, 12011, 10430, 12007, 10481, 11525, 11510, 11501, 10461, 10458, 10485, 10478, 10444, 10482; mean Brix, 22.69; mean sucrose, 17.65; mean purity, 78.17.

Block No. 10.

This block was plowed 10 inches deep and subsoiled to a depth of 16 inches. It was planted as follows: In plat 33, six rows of Early Amber were listed on the 22d of April. Plat 33, and extending four rows into plat 31, was planted with Early Orange on the 23d of April with a hoe. The rest of plat 31 with Early Orange, planted with a hoe, on the 24th of April.

Block No. 11.

This block was planted with Early Amber. Plat 36 was planted with a hoe on the 20th of April, and plat 34 with a lister on the 22d of April. This block was not subsoiled.

Block No. 12.

The planting of cane on the experimental field commenced on the 20th of April on this block. This block was planted as follows: On the north side are planted seven rows of variety No. 112 from pedigreed seed from Sterling, Kans., of the following numbers and mean composition: Seed-head numbers, 5989, 5789, 6055, 6104, 6105, 6108, 6152, 6176, 6180, 6195, 6199, 6204, 6211, 6233, 6239, 6348, 7888, 7891, 7895, 7902, 8130; mean Brix, 20.33; mean sucrose, 16.91; mean purity, 80.04.

Beginning with the eighth row from the north of plat 38, there are planted four rows of variety No. 126, from pedigreed seed heads from Sterling, Kans., of the following numbers and mean composition: Seed-head numbers, 11919, 11920, 11921, 11922, 11923, 11924, 11925; mean Brix, 21.26; mean sucrose, 15.98; mean purity, 75.65.

Three rows in the plat north of 38, of Early Amber; eleven rows of Early Amber on plat 39; four rows of No. 126 on plot 37, and seven rows of No. 112.

This block was not subsoiled and all of it was planted with a lister except three rows of Early Amber in the north plat, which were planted with a hoe. Varieties No. 112 and 126 were planted on the 27th of April.

Block No. 13.

This block was not subsoiled and all the cane was listed. Beginning on the south side, it was planted with six rows of No. 91, from pedigreed seed heads from Sterling, Kans., of the following numbers and mean composition: Seed-head numbers, 11941, 11953, 11954, 11957, 11958, 11959, 11968, 11970, 11972, 11975, 11976, 11979, 11981, 11984, 11998, 11991, 11992; mean Brix, 23.38; mean sucrose, 17.71 per cent; mean purity, 75.32; followed by two rows of No. 160, from pedigreed seed heads from Sterling, Kans., of the following numbers and mean composition: Seed-head numbers, 7156, 7164, 7169, 10603, 11381, 12204, 12206, 12213; mean Brix, 22.24; mean sucrose, 17.11; mean purity, 76.93; followed by eight rows of Alapor Jowar from bulk seed from Sterling, Kans., followed by eight rows of Folger's Early, from pedigreed seed-heads from Sterling, Kans., of the following numbers and mean composition: Seed-head numbers, 7828, 7777, 7049, 8042, 7174, 7864, 8044, 7222, 7796, 7705, 7793, 7527, 8039, 7069, 7233, 8033, 7461, 7858, 7361, 7858, 7361, 7856, 7062, 7595, 7180, 7861, 7972, 8040, 7991, 7710; mean Brix, 20; mean sucrose, 16.91; mean purity, 84.55. Next came two rows of Planters' Friend from pedigreed seed heads from Sterling, Kans., of the following numbers and mean composition: Seed-head numbers, 9759, 7983, 9758, 9848, 9754, 9788, 9835, 9821, 9794, 9844, 9832; mean Brix, 19.74; mean sucrose, 14.21; mean purity, 71.98.

Block No. 14.

This block was not deep-plowed. The cane was all listed, and beginning on the south side there were planted five rows of Folger's Early from pedigreed seed heads from Sterling, Kans., of the following numbers and mean composition: Seed-head

numbers, 8036, 7288, 7322, 7926, 7570, 7947, 7328, 7240, 7799, 7950, 7714, 7575, 7378, 7694, 7386, 7600; mean Brix, 19.15; mean sucrose, 15.47; mean purity, 80.78; followed by three rows of Early Amber from Sterling, Kans., of the following numbers and mean composition: Seed-head numbers, 3795, 5461, 5448, 5449, 5732, 5558, 2692, 3793, 3790, 5413, 2928, 5447, 5337, 5442, 125, 3478, 2603, 2927, 3788, 3779, 4253, 2682, 5735, 2945, 756, 5200, 5548, 5336, 5458; mean Brix, 20.58; mean sucrose, 16.8; mean purity, 81.63; followed by 16 rows of India and Orange planted from bulk seed from Sterling, Kans., on the 29th of April.

Block No. 15.

This block was planted on the 29th of April with a lister, beginning on the south side with 16 rows of Ubehlana, followed on the north with ten rows of Colman cane on the 29th of April.

DATA RELATING TO CANE GROWN ON THE EXPERIMENTAL FIELD.

CULTIVATION.

The cultivation of the station field was conducted under the superintendency of Mr. Eli Benedict, to whose skill and enthusiasm the success of the cultural part of the work is due. Mr. Benedict gave the work his personal attention and by his careful oversight secured from the laborers the necessary precautions favorable to the proper growth of the young plants.

In addition to the ordinary cultivation with harrow and plow, the plants were carefully hoed and thinned at from two to three weeks after coming up. The field was kept entirely free of weeds, the healthy and vigorous plants were retained in the process of thinning, and the agricultural aspect of the station at the time of the beginning of the harvesting was all that the most fastidious could desire.

The principles which controlled the cultivation were those naturally in force in the kind of climate prevailing at Medicine Lodge, namely, deep plowing in the preparation of the seed bed, thorough tilth of the surface secured by frequent stirring to shallow depth, and the proper attention to the young plantlets with the hand and hoe. So successful were the results of the cultural work that although during the latter part of July and nearly the whole of August a severe drought prevailed, yet there was no firing of the plants, the leaves remaining green down to the ground up to the time of its maturity.

Heretofore but little attention has been given to the necessity of careful culture, but the results of the first year of this kind of work are so encouraging as to lead to the entertainment of the hope that hereafter, in the growth of sorghum, the proper attention will be given to this important subject.

YIELD AND QUALITY.

It was thought best to make a comparative test of all the varieties of cane grown at as nearly as possible the same time. This was accomplished with all the varieties, except the Early Amber, the whole of

which was used up in trials of the machinery at the factory. The time selected for this test was one that would represent as well as possible all the different varieties. Some of our earlier varieties were perhaps a little over ripe and some of the later varieties were decidedly green, but the tests made apply fairly well to all the varieties as they appeared at the middle of September.

A measured quantity of an acre was taken for each determination. On serial numbers 2 to 10, inclusive, one row 1,000 feet long 3 feet 10 inches wide was cut, representing .088 of an acre. Eleven and four tenths (11.4) rows of this cane represent 1 acre. On serial numbers 1 and from 11 to 16, inclusive, the rows were 1,089 feet in length, representing .096 of an acre and 10.5 rows make 1 acre.

An attempt was made to have the canes cut and all the weighings made as quickly as possible, so as to avoid changes in weight in the leaves due to the evaporation of the water which they contain. This was not always possible, but in nearly all of the cases the leaves were weighed before they had had time to loose weight from the cause stated. The method of obtaining the weights was as follows:

The canes were cut and loaded in the field, the tops all being placed as evenly as possible on the wagon rack. The whole load was then weighed, the tops were immediately cut off with a cane knife, and the load reweighed, the difference in weights giving the weight of the seed tops. The seed tops were cut the usual length for manufacturing purposes. The topped cane was then run through the cutting and cleaning apparatus, and the trash which was separated by the cleaning apparatus collected and weighed. This weight deducted from the weight of the topped cane gave the weight of the cleaned cane entering the cells of the battery. The number of cells of the battery filled divided into the total weight of cleaned cane entering the battery gave the weight of cleaned cane chips in each cell. The data give an accurate idea of the proportion of whole cane, seed tops, and leaves contained in canes which are still green. All the varieties of cane were green and vigorous, the blades being green almost to the ground. Of course the relative weights of blades to the cleaned cane and seed tops would be greatly altered after frost.

DATA OBTAINED FOR EACH VARIETY.

Folger's Early.

This cane was cut on the 15th of September from block 13:

Weight of whole cane	pounds	2,700
Weight of seed tops	do	430
Weight of topped cane	do	2,270
Weight of trash, that is, the material blown out by the cleaning apparatus	pounds	323
Per cent of seed tops to whole cane		15.93
Per cent of trash to whole cane		11.96

Folger's Early—Continued.

Per cent of trash to topped cane		14.23
Yield of whole cane per acre	tons	13.96
Yield of seed tops per acre	do	2.23
Yield of trash per acre	do	1.67
Yield of cleaned cane per acre	do	10.07
Sucrose in the juice	per cent	15.75
Brix of the juice	do	22.40
Purity of the juice	do	70.3
Total quantity of sugar contained in the cleaned cane, per acre, pounds		2,745
Clean seed, per acre	pounds	2,340

The samples taken for analysis were obtained in the following way: As the cells of the battery were filling with the chips, ten small handfulls were taken out at as nearly as possible even intervals during the filling of the cells. The same method of sampling was followed throughout. The whole mass of chips thus obtained was then passed through a small sample mill and the juice expressed subjected to analysis. In this way it is believed that an absolutely fair sample of the cane is obtained.

Colman Cane.

Two samples of Colman Cane were taken from two separate plats. The first was taken from block No. 1 and was cut on the 16th of September.

Total weight of whole cane per acre	tons	12.08
Total weight of topped cane per acre	do	9.80
Total weight of cleaned cane per acre	do	8.09
Total weight of seed heads per acre	do	2.28
Total weight of trash per acre	do	1.66
Number of stalks per acre		14,022
Sucrose in juice	per cent	14.50
Yield of sugar per acre in cleaned cane	pounds	2,071

Link's Hybrid.

The sample of Link's Hybrid was also taken from block No. 1 and was by no means as good a sample as was growing on another block of the experimental field. It was harvested and examined on the 16th of September.

Weight of whole cane per acre	tons	10.72
Weight of topped cane per acre	do	8.95
Weight of cleaned cane per acre	do	7.67
Weight of seed tops per acre	do	1.77
Weight of trash per acre	do	1.26
Number of stalks per acre		11,434
Sucrose in juice	per cent	13.1
Purity of juice	do	68.70
Yield of sugar per acre in cleaned cane	pounds	1,758

Black African.

The sample of Black African examined was grown on Block No. 2. It was harvested and examined on the 16th of September.

Weight of whole cane per acre	tons..	13.17
Weight of topped cane per acre	do...	10.66
Weight of cleaned cane per acre	do...	9.17
Weight of seed tops per acre	do...	2.51
Number of stalks per acre		15,253
Weight of trash per acre	tons..	1.48
Yields of clean seed per acre	pounds..	1.093
Sucrose in the juice	per cent..	12.95
Purity of the juice	do...	69.70
Yield of sugar per acre in cleaned cane	pounds..	2,090

Early Orange.

The Early Orange was harvested and examined on the 15th of September. It was grown on block 3.

Whole cane per acre	tons..	14.54
Topped cane per acre	do...	12.08
Cleaned cane per acre	do...	9.86
Seed heads	do...	2.45
Trash per acre	do...	1.64
Number of stalks per acre		17,533
Weight of clean seed per acre		1,937
Sucrose in the juice	per cent..	10.20
Purity of the juice	do...	62.70
Yield of sugar per acre in cleaned cane		1,767

Collier cane.

This cane was harvested and examined on the 16th of September and was grown on block No. 3.

Weight of whole cane per acre	tons..	16.36
Weight of topped cane per acre	do...	14.35
Weight of cleaned cane per acre	do...	11.48
Weight of seed tops per acre	do...	2.00
Weight of trash per acre	do...	1.88
Weight of clean seed per acre	pounds..	1,304
Number of stalks per acre		24,339
Sucrose in the juice	per cent..	13.75
Purity of the juice	do...	69.2
Yield of sugar per acre in cleaned cane	pounds..	3,021

Colman cane.

This sample was harvested and examined on the 16th of September and was grown on block No. 3.

Yield of whole cane per acre	tons..	14.78
Yield of topped cane per acre	do...	13.11
Yield of cleaned cane per acre	do...	11.51
Yield of seed tops per acre	do...	2.52

Colman cane—Continued.

Yield of trash per acre	tons..	1.68
Yield of clean seed per acre	pounds..	2,384
Number of stalks per acre		20,995
Sucrose in the juice	per cent..	14.10
Purity of the juice	do...	71.6
Yield of sugar per acre in cleaned cane	pounds..	2,670

McLean.

Harvested and examined on the 16th of September and grown on block No. 3.

Yield of whole cane per acre	tons..	11.69
Yield of topped cane per acre	do...	9.58
Yield of cleaned cane per acre	do...	8.61
Yield of seed tops per acre	do...	2.11
Yield of trash per acre	do...	.97
Yield of clean seed per acre	pounds..	1,768
Number of stalks per acre		11,147
Sucrose in the juice	per cent..	13.55
Purity in the juice	do...	71.3
Yield of sugar in cleaned cane, per acre	pounds..	2,104

Variety No. 161.

Harvested and examined on the 17th of September. This sample was grown on block 6.

Yield of whole cane per acre	tons..	15.04
Yield of topped cane per acre	do...	12.65
Yield of cleaned cane per acre	do...	10.89
Yield of seed tops per acre	do...	2.34
Yield of trash per acre	do...	1.77
Yield of clean seed per acre	pounds..	1,904
Number of stalks per acre	do...	24,168
Sucrose in juice	per cent..	9.4
Purity in the juice	do...	59.9
Yield of sugar in cleaned cane per acre	pounds..	1,805

Variety No. 160.

This plat was harvested and examined onthe 17th of September. It was grown on block 9.

Yield of whole cane per acre	tons..	11.06
Yield of topped cane per acre	do...	9.41
Yield of cleaned cane per acre	tons..	8.38
Yield of seed tops per acre	do...	1.67
Yield of trash per acre	do...	1.03
Yield of seedper acre	pounds..	1,196
Number of stalks per acre		15,561
Sucrose in juice	per cent..	12.10
Purity in the juice	do...	67.2
Sugar in cleaned cane per acre	pounds..	1,995

Planter's Friend.

Harvested and examined on the 18th of September. Grown on Block No. 15.

Yield of whole cane per acre	tons..	14.58
Yield of topped cane per acre	do...	12.72
Yield of cleaned cane per acre	do...	10.60
Yield of seed tops per acre	do...	1.86
Yield of trash per acre	do...	2.12
Yield of seed per acre	pounds..	1,180
Number of stalks per acre		18,622
Sucrose in juice	per cent..	14.35
Purity of juice	do...	68.51
Yield of sugar in cleaned cane per acre	pounds..	1,870

India and Orange.

Harvested and examined on the 18th of September. Grown on Block No. 16.

Yield of whole cane per acre	tons..	13.80
Yield of topped cane per acre	do...	11.43
Yield of cleaned cane per acre	do...	9.56
Yield of seed tops per acre	do...	2.38
Yield of trash per acre	do...	1.86
Yield of seed per acre	pounds..	2,099
Number of stalks per acre		15,789
Sucrose in juice	per cent..	12.25
Purity of juice	do...	68.51
Yield of sugar in cleaned cane per acre	pounds..	2,059

Variety No. 91.

Harvested and examined on the 18th of September. Grown on Block No. 13:

Yield of whole cane per acre	tons..	14.33
Yield of topped cane per acre	do...	11.47
Yield of cleaned cane per acre	do...	10.19
Yield of seed tops per acre	do...	2.49
Yield of trash per acre	do...	1.76
Yield of seed per acre	pounds..	2,558
Number of stalks per acre		18,095
Sucrose in juice	per cent..	12.45
Purity of juice	do...	64.0
Yield of sugar in cleaned cane per acre	pounds..	2,237

Variety No. 126.

The cane was harvested on the 18th of September and was grown on Block No. 13:

Yield of whole cane per acre	tons..	10.01
Yield of topped cane per acre	do...	9.41
Yield of cleaned cane per acre	do...	7.01
Yield of seed tops per acre	do...	1.61
Yield of trash per acre	do...	1.39
Yield of seed per acre	pounds..	1,166
Number of stalks per acre		13,959
Sucrose in juice	per cent..	16.25
Purity of juice	do...	73.1
Sugar in cleaned cane per acre	pounds..	2,294

Variety No. 112.

Harvested and examined on the 18th of September. Grown on Block No. 13:

Yield of whole cane per acre	tons	13.28
Yield of topped cane per acre	do	11.27
Yield of cleaned cane per acre	do	9.53
Yield of seed tops per acre	do	2.01
Yield of trash per acre	do	1.76
Yield of seed per acre	pounds	2,558
Number of stalks per acre		19,874
Sucrose in the juice	per cent	14.15
Purity of juice	do	71
Weight of sugar in cleaned cane per acre	pounds	2,369

Ubehlana.

Harvested and examined on the 18th of September. Grown on Block No. 16:

Yield of whole cane per acre	tons	13.65
Yield of topped cane per acre	do	11.42
Yield of cleaned cane per acre	do	9.77
Yield of seed tops per acre	do	2.23
Yield of trash per acre	do	1.65
Yield of seed per acre	pounds	1,399
Number of stalks per acre		17,392
Sucrose in the juice	per cent	12
Purity of juice	do	65.8
Yield of sugar per acre of cleaned cane	pounds	2,090

The foregoing data, for convenience of reference, are collected in the following table:

Data calculated for one acre by careful measurement of cane grown on a measured area.

Serial No.	Variety.	Date.	Plot.	Area.	In sample.				
					Seed tops.	Whole cane.	Topped cane.	Trash.	Clean cane.
				Acre.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1	Folger's Early	Sept. 15	44	.096	430	2,700	2,270	323	1,947
2	Colman cane	Sept. 16	2	.088	400	2,120	1,720	290	1,430
3	Link's Hybrid	do	2	.088	310	1,880	1,570	220	1,350
4	Black African	do	5	.088	440	2,310	1,870	260	1,610
5	Early Orange	do	8	.088	430	2,550	2,120	290	1,730
6	Collier	do	8	.088	350	2,870	2,520	330	2,190
7	Colman cane	do	11	.088	460	2,760	2,300	280	2,020
8	Australian	do	11	.088	370	2,050	1,680	170	1,510
9	No. 161	Sept. 17	17	.088	410	2,630	2,220	310	1,910
10	No. 160	do	26	.088	290	1,940	1,650	180	1,470
11	No. 91	Sept. 18	38	.096	460	2,770	2,310	340	1,970
12	No. 126	do	38	.096	310	2,130	1,820	270	1,550
13	No. 112	do	38	.096	390	2,570	2,180	340	1,840
14	Planters' Friend	do	44	.096	360	2,820	2,460	410	2,050
15	India and Orange	do	47	.096	460	2,670	2,210	360	1,850
16	Ubehlana	do	47	.096	430	2,640	2,210	320	1,890

Data calculated for one acre by careful measurement of cane grown on a measured area—Continued.

Serial No.	Variety.	Seed tops on whole cane.	Trash on whole cane.	Trash on topped cane.	Per acre.					
					Whole cane.	Topped cane.	Clean cane.	Seed tops.	Trash.	Clean seed.
		Per ct.	*Per ct.*	*Per ct.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Lbs.*
1	Folger's Early	15.93	11.96	14.23	13.96	11.74	10.07	2.23	1.67	23.40
2	Colman cane	18.89	13.68	16.86	12.08	9.80	8.09	2.28	1.66	.....
3	Link's Hybrid	16.49	11.70	14.01	10.72	8.95	7.67	1.77	1.26	.....
4	Black African	19.00	11.26	13.90	13.17	10.66	9.17	2.51	1.48	10.93
5	Early Orange	16.86	11.37	13.68	14.54	12.08	9.86	2.45	1.64	19.37
6	Collier	12.20	11.50	13.09	16.36	14.35	11.48	2.00	1.88	13.04
7	Colman cane	16.66	10.15	12.17	14.78	13.11	11.51	2.52	1.68	23.84
8	Australian	18.05	8.29	10.12	11.69	9.58	8.61	2.11	.97	17.68
9	No. 161	15.59	11.79	13.96	15.04	12.65	10.89	2.34	1.77	19.04
10	No. 160	14.94	9.29	10.91	11.06	9.41	8.38	1.67	1.03	11.96
11	No. 91	17.33	12.27	17.59	14.33	11.47	10.19	2.49	1.76	25.58
12	No. 126	14.55	12.68	14.83	10.01	9.41	7.01	1.61	1.39	11.66
13	No. 112	15.18	13.23	15.60	13.28	11.27	9.53	2.01	1.76	25.58
14	Planters' Friend	12.77	14.54	16.67	14.58	12.72	10.60	1.86	2.12	11.80
15	India and Orange	17.23	13.48	16.29	13.80	11.43	9.56	2.38	1.86	20.99
16	Ubehlana	16.29	12.12	14.48	13.65	11.42	9.77	2.23	1.65	13.99

Serial No.	Variety.	No. stalks in sample.	No. stalks per acre.	Average weight of whole cane.	Average weight of clean cane.	Sucrose in juice.	Brix.	Purity.	No. cells filled.	Cane in each cell.	Sugar per acre.
				Lbs.	*Lbs.*	*Per ct.*	*Per ct.*			*Lbs.*	*Lbs.*
1	Folger's Early	.....	.....	.....	.....	15.75	22.40	70.3	.....	*	2,745
2	Colman cane	1,230	14,022	1.72	1.16	14.50	20.88	69.4	4.3	332	2,071
3	Link's Hybrid	1,003	11,434	1.87	1.35	13.10	19.07	68.7	3.9	346	1,758
4	Black African	1,338	15,253	1.73	1.20	12.95	18.57	69.7	5.0	322	2,090
5	Early Orange	1,546	17,523	1.65	1.12	10.20	16.26	62.7	5.7	304	1,767
6	Collier	2,135	24,339	1.34	1.03	13.75	19.88	69.2	6.0	365	3,021
7	Colman cane	1,970	20,995	1.40	1.03	14.10	19.71	71.6	6.0	337	2,670
8	Australian	1,505	11,147	1.36	1.00	14.55	20.41	71.3	4.95	306	2,104
9	No. 161	2,120	24,168	1.24	.90	9.40	15.70	59.9	5.7	335	1,805
10	No. 160	1,365	15,561	1.42	1.08	12.10	18.00	67.2	4.4	334	1,995
11	No. 91	1,750	18,095	1.58	1.13	12.45	19.44	64.0	5.8	339	2,237
12	No. 126	1,350	13,959	1.58	1.15	16.25	22.24	73.1	4.7	329	2,294
13	No. 112	1,922	19,874	1.34	.96	14.15	19.95	71.0	5.0	334	2,369
14	Planters' Friend	1,801	18,622	1.57	1.14	14.35	20.35	70.5	5.8	354	1,870
15	India and Orange	1,527	15,789	1.75	1.21	12.25	17.88	68.5	5.0	370	2,059
16	Ubehlana	1,682	17,392	1.57	1.12	12.00	18.38	65.8	5.2	363	2,090

* Not determined.

DESCRIPTIONS OF ABOVE CANES.

Folger's Early—Seed ripe. Canes sturdy and of even appearance.

Colman—Seed mostly hard, some in dough. Cane moderately tall, stocky, stands up well.

Link's Hybrid—Seed at least half in dough, rest moderately hard. Cane quite green, leaves all green to butts. Tall but stocky, stands up well.

Black African—Seed mostly hard, some in dough. Canes very tall and slender, in places badly tangled.

Early Orange—Seed hard. Cane stands up well.
Collier—Seed mostly in milk and dough. Cane very tall, but stands up well. Very green.
Colman—Seed mostly hard, very few being in dough. Cane stands straight and strong.
Australian—Seed hard. Cane had lain cut in sun from morning till 3 p. m; leaves wilted.
No. 161—Seed apparently ripe. Cane large, fine-looking, and stands up well. Leaves very green.
No. 160—Seed mostly hard, leaves green. Canes tall and slender, somewhat tangled.
No. 91—Seed apparently ripe, blades green. Canes tall, slender, of uneven height and standing well
No. 126—Seed ripe, leaves very green. Cane quite slender, standing well.
No. 112—Seed ripe, leaves very green. Cane short and stocky.
Planters' Friend—Seed mostly hard, but some in dough. Cane very vigorous; leaves green.
India and Orange—Seed mostly hard, but some in dough. Leaves very green. Cane vigorous and stocky.
Ubchlana—Seed half in dough; leaves quite green. Cane fine and stocky.

CULTURAL WORK AT CALUMET (PATTERSON, LA.)

[Conducted under the direction of Mr. WIBRAY J. THOMPSON, by Mr. F. E. COOMBS.]

The experimental cultivation of sugar-producing varieties of sorghum cane, the results of which for the seasons of 1889 and 1890 have already been published, was continued in 1891, with the employment of similar methods of planting, of agricultural treatment, and of chemical examination.

Effort was concentrated even more than in former years upon the selection of seed for propagation from canes of high value, and little or no time was given to investigating questions which did not possess an immediate bearing upon the main work of improvement of varieties. Such matters as tonnage, appropriate fertilizers, and the like are certainly of the highest importance in their influence upon the final success or failure of the plant as an economic source of sugar, but it is primarily necessary to acquire a sorghum which shall insure reasonably good returns for the expense of its proper cultivation. And, having gained that point, its agricultural needs would be more properly the province of State experiment stations to discover than of individual planters, who are generally quite too busily occupied in the practice to afford much time to the theory of agronomy.

Recognizing, however, the need of establishing for how long a period the more valuable varieties of sorghum can be trusted to furnish, continuously, canes of high purity and sucrose after a satisfactory condition in these regards has been reached during the plant's growth, as well as the value of analyses of average samples in the comparison of varieties, a limited number of such was chosen and plots of large size were planted, intended to furnish average samples unvitiated by any culling out of canes for seed selection. All the average samples analyzed were drawn from these plots, and none of the seed selection plots were used for any work besides analyses of single canes.

Among the striking peculiarities of sorghum cane, and one which has been noticed throughout the whole time of its culture on this plantation, is its extreme susceptibility to variation of weather or of soil. It has been found that for any variety of sorghum grown here no period of growth—or, better, length of time required from germination to maturity—can be even approximately assigned. For the same variety, grown in two seasons, or planted at different dates in the same season, this period may differ by from three to nearly six weeks. This fact is one which for the present sets at naught any attempt to arrange two or more plantings which shall follow each other with any reasonable regularity in date of ripening.

Before proceeding with the account of the season's results, the valuable assistance rendered in the laboratory and otherwise by Mr. O. D. Berwick, jr., of Bayou Sale, La., should be acknowledged.

EXPERIMENTS OF 1891.

In the season's experiments two plantings were made at different dates, it being judged unwise to risk the result of past years' propagation work to the chances of entire loss by drought or excessive rains which might destroy one planting, but would scarcely continue long enough to endanger two. By this plan, also, it was hoped to distribute the selection of seed over a longer period, avoiding much hurried and therefore unsatisfactory work in the laboratory.

After study of the field and chemical data collected during the seasons of 1889 and 1890 at Calumet, with many varieties of sorghum, it was decided to continue trial of the following ten: Early Orange, Link's Hybrid, Collier's, Ubehlana, Improved Orange, Late Orange, Planter's Friend, Colman Cane, Sterling (plat No. 14 of 1888), Red Liberian.

Of these varieties, Colman Cane, Collier's, Planter's Friend, Link's Hybrid, Early, Late, and Improved Orange, were considered to be of best promise. Red Liberian and Sterling (plat No. 14) were retained for a final trial, but with little expectation that they would prove better than in the past. Besides the Calumet-grown stock of Colman Cane, Collier's, and Link's Hybrid, a number of selected seed heads of these varieties, grown at Sterling, Kans., in 1890, were received from Mr. A. A. Denton, superintendent of the Department of Agriculture experiment station at that place. From him were also received a few heads labeled "Sterling, lot No. 161," described as a cross of Link's Hybrid with Early Amber, resembling in form the Link's Hybrid type.

In addition to the above a few special plats were made with seed from certain large sports or crosses produced in several of the 1890 plots. The varieties upon which seed selection work was done this season were planted in plats each from a single head, as before noted, and were in most cases duplicated in the two plantings.

The field in which the 1891 plats were grown was one upon which no sorghum had been previously planted, and was in a crop of ratoon

sugar cane when chosen. On March 27 the stubble of this cane was plowed out and destroyed, the soil very thoroughly loosened, and the rows destined for the sorghum were further mellowed and opened out by hoe and in readiness for planting. The earth being in excellent condition at this time, the first series of plats was seeded on the following day, dropping and covering to a depth of 1 inch, being done by hand as in all former experiments with sorghum here.

To guard against likelihood of crossing, alternate parallel rows, 28 feet apart, were used for the first series of plats, and as far as practicable, the latter maturing varieties intervened between the earlier kinds. The alternate unused rows were afterward occupied by the later planting. When both series had been planted the order was as follows: Plat No. 1, an early variety, first series; plat No. 2, an early (or late) variety, second series; plat No. 3, a late variety, first series; plat No. 4, a late (or early) variety, second series, etc., these neutral plats thus always lying between any two which were at all likely to be in flower at the same period. Three tiers of parallel rows completed the field, with plenty of space between the opposite ends of the plats.

Seed were planted much more thinly than in former seasons and the little thinning of canes afterward needed was done as required. Cultivation was confined to keeping the rows free from weeds and grass and the soil from baking on the surface, and was chiefly effected by hand hoeing. One plowing was given to this series on the one hundred and eighth day, breaking out the soil between the rows at a distance sufficient to avoid damaging the roots, this being the final working.

On the 30th of March, the second day following, three large plats (single rows) were planted for the average sample work, these being designated by letters and representing Collier's, Link's Hybrid, and Colman Cane, and on April 1 a fourth such plat (of Early Orange), the last being planted with and receiving the same scanty attention as a crop of Red Liberian grown for forage in another field.

A week of cold weather ensued, frost forming on the night of April 5, and germination was checked, very few plants having shown above the ground. Following upon this setback was a drought, but two inappreciable showers falling in seventy-one days, from March 28 to June 7, on the latter date a rain of $1\frac{3}{4}$ inches occurring. The influence of this dry weather was disastrous upon the sorghum, and was intensified by the fact that no cultivation was given the plats while it lasted, thus allowing the surface of the ground to bake and harden. At the date last mentioned the plats hardly averaged a 25 per cent stand, and the canes which survived were of all heights and sizes, and to all appearances the whole planting seemed an utter failure. From June 7 to 18 warm, wet weather prevailed, 6 inches of measured rainfall occurring in this period, which not only produced a great improvement in canes already up, but also caused an unlookedfor germination of seed which had lain in the ground since the date of planting, more than two months

before. Dry, hot weather succeeded until the 25th of June; afterwards, alternations of hot and bright weather with frequent rains afforded excellent growth conditions until the 24th of August, when a term of unusually low temperature began, the thermometer reaching a minimum of 57° F. on the night of the 25th, and no really warm days were experienced until the first of September, by which time the canes of the first planting had for the most part reached full maturity.

The effects of the weather conditions upon the first series were: A check to germination at the start, due to low temperature injuring all the plots and destroying two of them entirely; a further injury by drought, preventing germination of such seed as had not sprouted at the outset and retarding growth generally, this evil being possibly increased by the lack of cultivation. The average length of time required by this series before the panicles appeared exceeded that of the second series by forty two days; very great improvement in all the plots by hot, moist weather, the stand largely increasing by the starting up of dormant seed. Agriculturally considered, this planting was far from successful, and a crop of sorghum grown for sugar making under the same conditions would have been a complete loss.

Below are given the plats of the first series, showing the source and juice analysis of the parent (1890) canes, best single stacks found in the derived (1891) plats, and any notes of description which seem worth recording.

FIRST SERIES—PLANTED FROM SINGLE HEADS FOR SEED SELECTION.

Plat No. 1 (*Early Orange*).—Derived from best single cane selected from Calumet Plat B, 1890, cut on the one hundred and seventh day from planting. Juice of this cane, serial No. 458, 1890: Sucrose, 15.35; purity, 75.69; glucose, .59; nonsugars, 4.34. Best single stalk of derivate plat, serial No. 284, 1891, cut on the one hundred and fifty-fourth day: Sucrose, 16.85; purity, 80.97; glucose, .59; nonsugars, 3.37. About 40 per cent stand was attained. Panicles fully developed by the one hundred and twentieth day; seed matured by the one hundred and forty-sixth.

Plat No. 3 (*Red Liberian*).—Derived from the best single cane selected from Calumet Plat 5 A, 1890, cut on the one hundred and thirty-fourth day from planting. Juice analysis of this cane, serial No. 207, 1890: Sucrose, 14.20; purity, 71.53. Best single stalk of derivate plat, serial No. 457, 1891, cut on its one hundred and sixty-fourth day: Sucrose, 16.15; purity 74.73; glucose, 2.46; nonsugars, 3. Panicles fully out by the one hundred and twentieth day; seed hard by the one hundred and fortieth day. This variety is to be discontinued at Calumet, having given in two years' culture no canes of as high analysis as the parent (Kansas) stock, being too low in purity to warrant further trial, and having nothing to recommend it in point of size or form.

Plat No. 5 (*Link's Hybrid*).—Derived from the second best single cane selected from Calumet Plat C, 1890, cut on the one hundred and thirty-fourth day from planting. Juice analysis of this cane, serial No. 497, 1890: Sucrose, 15.10; purity, 79.97. Best single stalk of derivate plat, serial No. 332, 1891, cut on the one hundred and fifty-seventh day: Sucrose, 18.45; purity, 82.55; glucose, .74; nonsugars, 3.16. Panicles for the most part developed by the one hundred and thirteenth day; seed hardening by the one hundred and fortieth day. Stand of about 80 per cent secured. Notably a variety prone to offshoots.

Plat No. 7 (*Collier's*).—Derived from the second best single cane selected from Calumet Plat No. 22, 1890, cut on its one hundred and twenty-third day. Juice analysis of this cane, serial No. 414, 1890: Sucrose, 17.15, purity, 80.93. Best single stalk of derivate plat, serial No. 226, 1891, cut on its one hundred and fifty-first day: Sucrose, 18.95; purity, 83.59; glucose, .57; nonsugars, 3.15. Panicles fully out by the one hundred and thirteenth day; seed brittle by the one hundred and forty-seventh day. Very slender canes, remarkably scanty in seed production; 40 per cent stand attained.

Plat No. 9 (*Link's Hybrid*).—Derived from the best of two single seed heads grown at Sterling, Kans., in 1890, and received from Mr. A. A. Denton. Juice analysis of the parent cane, labeled "Lot No. 59, serial No. 12041, 1890:" Sucrose, 17.10; purity, 79.90. Best single stalk of derivate plat, serial No. 135, 1891, cut on the one hundred and forty-seventh day: Sucrose, 18.00; purity, 89.78; glucose, .78; nonsugars, 1.27. Many panicles out by the one hundred and twentieth day, but development was not regular, and as many canes had at that date no indication of heading. Seed for the most part hard by the one hundred and forty-seventh day. A very poor stand of rather slim canes. Fewer offshoots than the older (Calumet) stock.

Plat No. 11 (*Ubehlana*).—Derived from the best single cane selected from Calumet Plat No. 18, 1890. Juice analysis of this cane, serial No. 227, 1890, cut on the one hundred and thirty-fourth day: Sucrose, 14.60; purity, 73.18. Best single stalk of derivate plat, serial No. 504, 1891, cut on its one hundred and sixty-eighth day: Sucrose, 17.55; purity, 77.48; glucose, 1.50; nonsugars, 3.60. Panicles fully out by the one hundred and twenty-fifth day; seed hard by the one hundred and fifty-fifth day. This plat was nearly destroyed by the cold weather at the beginning of the season, and was very gappy and irregular. Such canes as survived maintained the previous record of the variety for large size and abundant yield of juice.

Plat No. 13 (*Improved Orange*).—No seed germinated.

Plat No. 15 (*Planter's Friend*).—Derived from the best single cane selected from Calumet Plat, No. 17, 1890. Juice analysis of this cane, serial No. 269, 1890, cut on its one hundred and thirty-seventh day: Sucrose, 17.00; purity, 78.63. Best single stalk of derivate plat, serial No. 363, 1891, cut on its one hundred and fifty-eighth day: Sucrose, 20.10; purity, 81.44; glucose, .92; nonsugars, 3.66. Panicles all fully out by the one hundred and twentieth day; seed hard by the one hundred and forty-eighth day. A moderately good stand was secured in this plat; canes of only fair size.

Plat No. 17 (*Late Orange*).—Derived from the second best single cane selected from Calumet Plat No. 6, 1880. Juice analysis of this cane, serial No. 3, 1890, cut on its one hundred and twenty-first day: Sucrose, 16.25; purity, 79.58. Best single stalk of derivate plat, serial No. 440, 1891, cut on its one hundred and sixty-fourth day: Sucrose, 18.50; purity, 82.92; glucose, 1.22; nonsugars, 2.58. Panicles out by the one hundred and thirteenth day; seed hardening by the one hundred and forty-fifth; a good stand of vigorous canes. Noted, however, with Plat No. 18, also Late Orange, as the only canes seriously affected with "red disease" this season.

Plat No. 19 (*Colman Cane*).—No canes came up.

Plat No 21 (*Sterling, Kans., Lot No. 161, 1890*).—Derived from the best of two single heads grown at Sterling in 1890, and received from Mr. A. A. Denton. Juice analysis of parent cane, serial No. 10050, Sterling, 1890: Sucrose, 16.95; purity, 79.30. Best single stalk of derivate plat, serial No. 179, 1891, cut on its one hundred and forty-ninth day: Sucrose, 17.50; purity, 81.13; glucose, .53; nonsugars, 3.54. Panicles fully out by the one hundred and thirteenth day; seed hard about one hundred and thirty-fifth day. The canes of this plat and of Plat No. 22 (same variety) were very deficient in seed-producing power, the primary panicles being almost or quite barren. A very good stand was grown in this plat, but the canes were exceedingly slender and developed axillary panicles profusely, each cane bearing from three to four of them as early as the one hundred and twentieth day; not a satisfactory variety in any respect.

Plat No. 23 (Sterling, Kans., Plat No. 14 of 1888.)—Derived from the best single cane selected from Calumet Plat No. 13, 1890. Juice analysis of this cane, serial No. 254, 1890, cut on its one hundred and thirty-sixth day: Sucrose, 15.35; purity, 76.02. Best single stalk of derivate plat, serial No. 371, 1891, cut on its one hundred and fifty-eighth day: Sucrose, 16.25; purity, 79.02; glucose, 1.50; nonsugars, 2.80. Many (reverting?) canes in this plat and in Plat No. 24, same variety, were noted as approaching the "gooseneck" form in varying degrees. Not a variety worth further experiment here.

Plat No. 39 (Collier's, Sterling, Kans., lot No. 1 of 1890).—Derived from the best of two single heads grown at Sterling in 1890, and received from Mr. A. A. Denton. Juice analysis of parent cane, serial No. 9170, 1890: Sucrose, 17.89; purity, 82.03. Best single stalk of derivate plat, serial No. 324, 1891, cut on its one hundred and fifty-sixth day: Sucrose, 20.55; purity, 82.10; glucose, .51; nonsugars, 3.97 Panicles all fully out by the one hundred and thirteenth day; seed hardening by the one hundred and forty-fifth. A thin stand of unevenly developed canes. The same tendency to barrenness of panicles as remarked of other plats of this variety.

SPECIAL PLATS—CROSSES OR VARIATIONS.

Plats Nos. 25 to 37, inclusive, were planted from certain specially noted and large canes found among the various plats grown in 1890, and selected chiefly on account of size. A little analytical work was done on all of these special plats, but only one of them was found at all promising.

Plat No. 27 (from a plat of Red Liberian).—Derived from a large cane selected from Calumet plat, No. 5 A, 1890. The parent cane was noted for very great size and late maturity, and was in appearance totally unlike any variety tried on this plantation. On the one hundred and eighty-sixth day, when cut and analyzed, this cane was 15 feet in total length and something over 1 inch in diameter at the largest internode. Juice analysis, serial No. 706, 1890: Sucrose, 9.25; purity, 65.84; glucose, 1.24; nonsugars, 3.56. Best single stalk of derivate plat, serial No. 583, 1891, cut on its one hundred and seventy-ninth day: Sucrose, 11.15; purity, 64.46; glucose, 2.33; nonsugars, 3.82. Less than a dozen seeds were secured from the parent cane, nine of which came up, and by profused tillering gave an excellent stand. Panicles appearing at irregular intervals, the first being observed on the one hundred and thirtieth day. On the one hundred and forty-eighth day, nineteen canes were growing in this plat; on the one hundred and fifty-fifth day seed began to mature, the tillers being indistinguishable from the seedlings, and all were of as remarkably large size as the original 1890 cane.

Excepting Plat No. 27, all the special plats of the first planting were characterized by great diversity of form and type among the canes produced, and were noted rather for size than for any value as sugar-producing varieties. Enough analytical work was performed on them to sufficiently demonstrate their unfitness for further propagation. But No. 27 showed the marks of a stable variety, and its large canes and their yield of juice seem worth an attempt towards raising its chemical standard and shortening its period of growth by future selection.

LARGE PLATS FOR AVERAGE SAMPLES.

Plat A (Early Orange).—Planted with mixed selected seed from several canes grown in Calumet Plat B, 1890. A single long row in the midst of a field of Red Liberian (forage crop) was used for this crop, and afterwards intentionally received the same lack of attention and cultivation. Drought led to the abandonment of this plat, scarcely any stand being secured by the one hundred and eighteenth day, and a second planting with the remaining portion of the same seed was made elsewhere. Later rains so helped matters that a return was made to the original plat and analytical work regularly done upon the canes. Juice analysis of an average sample from the parent

plat, Serial No. 170, 1890, cut on the one hundred and twenty-second day: Sucrose, 8.00; purity, 62.69; glucose, 1.43; nonsugars, 3.33. Best average sample from derivate plat, Serial No. 4, 1891, cut on the one hundred and forty-ninth day: Sucrose, 12.85; purity, 78.21; glucose, 1.52; nonsugars, 2.06.

Plat B (*Collier's*). Planted March 30 with mixed selected seed from canes grown in Calumet Plat No. 22, 1890. Analysis of an average sample from parent plat, Serial No. 106, 1890, cut on the one hundred and nineteenth day: Sucrose, 16.60; purity, 77.14; glucose, 0.69; nonsugars, 4.23. Best average sample from derivate plat, Serial No. 11, 1891, cut on the one hundred and fifty-fourth day: Sucrose, 18.35; purity, 81.11; glucose, 0.61; nonsugars, 3.65. Though much injured by drought, this plat gave a good stand. Barrenness of panicles as pronounced as in all plats of this variety.

Plat C (*Link's Hybrid*).—A failure; only half a dozen canes were produced.

Plat D (*Colman Cane*).—Planted March 30 with mixed selected seed from canes grown in Calumet Plat A, 1890. A very fair stand of handsome stocky uniform canes. Average of ninety-six single stalk analyses of parent plat, 1890: Sucrose, 15.12; purity, 75.94. Best average sample from derivate plat Serial No. 30, 1891, cut on its one hundred and seventy-fifth day: Sucrose, 18.90; purity, 81.47; glucose, 0.57; nonsugars, 3.73. This was in all points the best plat grown in 1891. Although designed for average sample work only, yet owing to the inferior canes afforded by the single head plats of Colman cane two days of seed selection work were given to this plat, but the canes were so taken as to interfere scarcely at all with the value of the average samples.

Average samples from the foregoing lettered plats were drawn by cutting ten consecutive canes at each sampling, beginning at one end of the row and progressing toward the other. Samples were taken from all the plats on the same date and at (usually) weekly intervals throughout the season. A sample was in the same manner taken from a row of the forage sorghum adjoining Plat A on each occasion.

SECOND SERIES—PLANTED FROM SINGLE HEADS FOR SEED SELECTION.

The second series of plats, all from single heads, were planted on June 8, after newly plowing out the rows, in the same field and in alternation with the plats of the earlier series. The conditions of weather which prevailed during the period between June 8 and October 15 favored a steady and regular growth. A perfect stand was had in all these plats. The cultivation was similar to that given the first series, but better timed.

Plats and varieties were as follows:

Plat No. 2 (*Early Orange*).—Derived from the second best single cane selected from Calumet Plat B, 1890. Juice analysis of this cane, Serial No. 455, 1890, cut on its one hundred and seventh day: Sucrose, 14.75; purity, 76.50. Best single stalk of derivate plat, Serial No. 591, 1891, cut on the one hundred and ninth day: Sucrose, 16.90; purity, 80.67; glucose, 0.98; nonsugars, 3.07. Panicles fully out by the sixty-eighth day, seed-hardening by the ninety-third day. A handsome plat, canes of fair size, and remarkably regular in form and type.

Plat No. 4 (*Red Liberian*).—(It was decided to discontinue the variety, and no analytical work was done upon the plat.)

Plat No. 6 (*Link's Hybrid*).—Derived from the best single cane selected from Calumet Plat C, 1890. Juice analysis of this cane, serial No. 496, 1890, cut on the one hundred and ninth day: Sucrose, 15.60; purity, 78.54; glucose, 0.36; nonsugars, 3.52. Best single stalk of derivate plat, Serial No. 814, 1891, cut on the one hundred and twenty-seventh day: Sucrose, 16.39; purity, 79.99; glucose, 0.65; nonsugars, 3.45. Panicles fully out by the sixty-eighth day, seed hardening by the ninety-third day. Canes slenderer than those of Plat No. 5 of the same stock, first series.

Plat No. 8 (*Collier's*).—Derived from the best single cane selected from Calumet Plat No. 22, 1890. Juice analysis of this cane, Serial No. 403, 1890, cut on the one hundred

and twenty-third day: Sucrose, 17.60; purity, 84.65. Best single stalk of derivate plat, Serial No. 558, 1891, cut on the one hundred and fifth day: Sucrose, 19.15; purity, 83.12. Panicles fully out by the sixty-eighth day; seed hardened by the ninety-third day. Seed scanty, but more produced than in plats 7 to 39 of same variety. This plat was planted from a cane of very high purity, with the intent of making a special effort to breed a strain having that characteristic. The fact that 66.7per cent of all the canes analyzed in this plat showed purity of 80 per cent or above (the lowest being 76.9) is sufficient comment upon one phase of artificial selection.

Plat No. 10 (*Link's Hybrid*).—Derived from the second choice of two single heads grown at Sterling, Kans., in 1890, and received from Mr. A. A. Denton. Juice analysis of the parent cane labeled, "Lot No. 60," Serial No. 11996, 1890: Sucrose, 18.25; purity, 78.05. Best single stalk of derivate plat, Serial No. 597, 1891, cut on the one hundred and ninth day: Sucrose, 17.15; purity, 80.06; glucose, 0.93; nonsugars, 3.34. Panicles fully out by the sixty-eighth day; seed brittle by the ninety-third day. Canes not very regular in height or size but type of panicle uniform. A heavy seed-bearing variety.

Plat No. 12 (*Ubehlana*).—Derived from the second best cane selected from Calumet Plat No. 18, 1890. Juice analysis of this cane, Serial No. 334, 1890, cut on its one hundred and forty-seventh day: Sucrose, 14.14; purity, 73.24. Best single stalk of derivate plat, Serial No. 900, 1891, cut on the one hundred and thirty-first day: Sucrose, 16.15; purity, 77.16; glucose, 2.07; nonsugars, 2.74 (apparently not a mature cane). Panicles fully out by the seventy-sixth day; seed hardening by the one hundred and twentieth day. Canes as a rule of moderately large size and of very uniform type and development.

Plat No. 14 (*Improved Orange*).—Derived from the best single cane selected from Calumet Plat, No. 8, 1890. Juice analysis of this cane, Serial No. 75, 1890, cut on its one hundred and twenty-seventh day: Sucrose, 17.10; purity, 77.46. Best single stalk of derivate plat, Serial No. 560, 1891, cut on the one hundred and fifth day: Sucrose, 17.80; purity, 80.84. Panicles all fully out by the seventy-sixth day, some appearing, however, eight days earlier. Seed hard to brittle by the ninety-third day. Stand not satisfactory and canes of rather small size.

Plat No. 16 (*Planter's Friend*).—Derived from the best single cane selected from Calumet Plat No. 17, 1890. Juice analysis of this cane, Serial No. 216, 1890, cut on the one hundred and thirty-fourth day: Sucrose, 17.65; purity, 77.92. Best single stalk of derivate plat, Serial No. 630, 1891, cut on the one hundred and twelfth day: Sucrose, 17.00; purity, 77.87; glucose, 1.42; nonsugars, 3.41. Panicles all fully out by the sixty-eighth day, seed hardening by the one hundred and twentieth day. This plat was the poorest in stand of the second series. Canes slender and greatly damaged by worms when about 15 inches tall, never recovering entirely. Type of heads not uniform.

Plat No. 18 (*Late Orange*).—Derived from the best single cane selected from Calumet Plat No. 6, 1890. Juice analysis of this cane, Serial No. 2, 1890, cut on its one hundred and twenty-first day: Sucrose, 16.60; purity, 79.35; glucose, 2.19; nonsugars, 2.13. Best single stalk of derivate plat, Serial No. 836, 1891, cut on the one hundred and twenty-eighth day: Sucrose, 17.00; purity, 80.68; glucose, 1.64; nonsugars 2.35. Panicles fully out by the sixty-eighth day; seed hard by the one hundred and tenth day. Slender canes of uniform type.

Plat No. 20 (*Colman Cane*).—Derived from the third choice single cane, selected from Calumet Plat No. 16, 1890. Juice analysis of this cane, Serial No. 301, 1890, cut on the eighty-fourth day: Sucrose, 16.75; purity, 78.93. Best single stalk of derivate plat, Serial No. 827, 1891, cut on the one hundred and twenty-eighth day: Sucrose, 16.85; purity, 81.28; glucose, 1.06; nonsugars, 2.82. Panicles fully out by the sixty-eighth day; seed hardening by the ninety-third day. Very short, slender canes, but perfectly true to type of the variety otherwise. This plat was originally

intended to be planted with seed selected from Calumet Plat A of 1890, the single head plat of that year and variety, but the seed reserved for the purpose were found to be musty when the time came for planting, and Serial No. 301, from another plat, was substituted, this plat, No. 16 of 1890, having been derived from the mixed seed of two heads of lower quality.

Plat No. 22 (Sterling, Kansas, "Lot No 161," 1890).—Derived from the second choice of two single heads grown at Sterling in 1890, and received from Mr. A. A. Denton. Juice analysis of this cane labeled, "Lot No. 161, Serial No. 8189, 1890:" Sucrose, 14.60; purity, 81.60. Best single stalk of derivate plat, Serial No. 642, 1891, cut on the one hundred and thirteenth day: Sucrose, 16.05; purity, 81.66; glucose, .71; nonsugars, 3.09. Panicles fully out by the sixty-eighth day; seed hard by the ninety-third day. Few seed were produced by the canes of this plat, but the sterility was not so nearly absolute as in case of Plat No. 21 of the first series, same variety.

Plat No. 24 (Sterling, Kans., Plat No. 14 of 1888).—No analytical work was done upon canes of this plat, as it was decided to drop the variety.

Plat No. 26 (Special from a plat of Red Liberian).—Derived from a single large cane selected from Calumet Plat No. 5 A, 1890, differing in some respects from the Red Liberian type. Juice analysis of this cane, Serial No. 232, 1890, cut on the one hundred and thirty-fourth day (when still immature): Sucrose, 9.30; purity, 45.70; glucose, 6.44; nonsugars, 4.61. Best single stock of derivate plat, Serial No. 739, 1891, cut on the one hundred and twenty-first day: Sucrose, 14.35; purity, 76.78; glucose, 1.71; nonsugars, 2.63. Panicles fully out by the sixty-eighth day; seed hard by the ninety-third day. Canes of good form and fair size, apparently crossed, the type of panicles varying in only slight degrees from stock Red Liberian, than which this seems to be somewhat earlier in maturing. Comparison of analyses from parent and derivate plots shows enough improvement to warrant another season's culture.

Plat No. 28 (Colman Cane).—Derived from the best of two single canes grown at Sterling, Kans., in 1890, and received from Mr. A. A. Denton. Juice analysis of parent cane, labeled "Serial No. 8277, 1890:" Sucrose, 16.23; purity, 83.50. Best single stock of derivate plat, Serial No. 652, 1891, cut on the one hundred and thirteenth day: Sucrose, 16.00; purity, 79.01; glucose, 1.20; nonsugars, 3.05. Panicles fully out by the sixty-eighth day; seed hard by the ninety-third day. Canes of fair average size, but showed many variations, some nearly like Planter's Friend. Apparently crossed, and no seed from this plat will be planted in 1892.

COMPARISON OF VARIETIES—FIRST AND SECOND PLANTING.

Excepting in Plats A, B, and D, no analyses of average samples were made, hence in all comparisons between single-head plats the results of single-stalk examinations are relied upon for the necessary data.

On looking over the analyses of the two plantings the most striking circumstance is the higher sucrose and purity shown by canes of the earlier series, despite the unfavorable nature of the season attending their germination and growth. Both plantings were made upon practically the same soil, and were given nearly the same treatment, with the advantage in point of attention and cultivation in favor of the second series. In most instances difference of seed will not offer adequate explanation. It suggests the opinion that any agent operating to retard growth and delay maturity may, within certain undetermined limits, tend toward an increase in the sugar-storing function of the plant. Why this should be, and whether as a matter of fact it is so, can not be conclusively stated, but indications point to that probability.

In the laboratory, Early Orange, Link's Hybrid, Collier's, Planter's Friend, and Colman Cane all far exceeded in the earlier any results reached with them in the later planting. Late Orange showed no very great difference in either. Of the whole number of varieties, only one, Sterling Lot No. 161, gave better chemical returns in its plat of the later series than in that of the first.

Agriculturally, the plats of the second planting were much better than those of the first, not so much, however, in the size of the canes produced as in their greater regularity of development, evenness of stand, and better form. Varieties of either planting, when derived from the same 1890 stock, showed no marked difference in size between mature canes.

TABLE I.—*Highest three single canes of each plat in sucrose and in purity, for the year 1891.*

Plat No.	Variety.	Canes examined.	Sucrose.	Purity.	Plat No.	Variety.	Canes examined.	Sucrose.	Purity.
1	Early Orange	70	16.9	81.0	15	Planter's Friend	114	20.1	83.0
			16.9	80.9				19.8	82.4
			16.7	80.0				19.7	81.9
2	do	90	17.1	82.0	16	do	75	17.0	78.3
			16.9	80.7				16.8	78.3
			16.3	80.5				16.6	77.9
3	Red Liberian	119	16.2	76.4	17	Late Orange	133	18.5	82.9
			16.0	75.7				17.8	82.0
			15.9	75.7				17.8	81.5
5	Link's Hybrid	110	18.5	82.6	18	do	99	17.0	80.7
			18.1	82.1				16.7	78.5
			17.8	81.4				16.4	78.4
6	do	93	16.4	80.0	20	Colman Cane	93	16.9	81.3
			16.2	79.4				16.9	81.3
			16.1	79.3				16.9	79.9
7	Collier's	95	19.2	83.6	21	Sterling Lot, No. 161 (1890)	101	17.5	82.2
			19.1	82.8				17.4	81.1
			19.1	82.6				16.9	80.1
8	do	158	19.6	83.1	22	do	70	16.7	81.7
			19.6	82.4				16.6	80.4
			19.3	82.4				16.6	79.5
9	Link's Hybrid (Kansas, 1890).	57	18.5	89.8	23	Sterling Plat No. 14 (1888)	83	16.4	79.1
			18.3	83.0				16.4	78.4
			18.1	82.4				16.4	78.4
10	do	129	17.4	81.4	28	Colman Cane (Kansas, 1890)	156	16.2	79.4
			17.3	80.1				16.1	79.0
			17.2	79.6				16.1	78.9
11	Ubehlana	42	17.6	77.7	39	Collier's (Kansas, 1890)	140	20.6	82.7
			17.1	77.6				20.5	82.3
			16.9	77.5				20.1	82.2
12	do	118	16.2	77.2	"D"	Colman Cane	80	19.9	82.6
			16.2	77.2				19.9	82.2
			16.1	77.1				19.7	81.6
14	Improved Orange	70	17.8	80.8					
			17.6	80.1					
			17.4	79.9					

In Table I, foregoing, are given the best three single stalk-juice analyses, in sucrose and purity, of each plat, disregarding whether or not the same cane exhibited both the best sucrose and the best purity, a coincidence not very frequent. The table is chiefly interesting as showing the maximum attained by each plat, but although of a certain value also in comparing the various stocks, it can not be made a basis of any sound deductions as to their actual merits. Principal depend-

ence for that end is placed in Table II, following, which is a synopsis of the laboratory results with each variety for the whole season.

TABLE II.—*Number of single-stalk analyses, showing purity at or above 77 per cent and sucrose at or above 16 per cent per 100 canes examined during the season of 1891.*

FIRST SERIES, PLANTED MARCH 28, 1891.

Plat No.	Variety.	Canes examined.	Per cent, 77 purity or over.	Per cent, 16 sucrose or over.
1	Early Orange	70	32.86	18.57
3	Red Liberian	119	None	1.68
5	Link's Hybrid	110	33.64	23.36
7	Collier's	95	44.21	44.21
9	Link's Hybrid (Kansas, 1890)	57	35.09	21.05
11	Ubehlana	42	9.52	23.81
15	Planter's Friend	114	31.58	39.47
17	Late Orange	133	15.04	15.04
21	Sterling (Kansas), Lot No. 161, 1890	101	9.90	6.93
25	Sterling, Plat No. 14 (1888)	83	1.20	1.20
39	Collier's (Kansas, 1890)	140	43.57	42.14
D	Colman Cane	80	32.50	36.25

SECOND SERIES, PLANTED JUNE 8, 1891.

Plat No.	Variety.	Canes examined.	Per cent, 77 purity or over.	Per cent, 16 sucrose or over.
2	Early Orange	90	22.22	4.44
6	Link's Hybrid	93	17.20	3.23
8	Collier's	158	29.75	30.38
10	Link's Hybrid (Kansas, 1890)	129	29.46	20.16
12	Ubehlana	118	2.54	3.39
14	Improved Orange	70	31.43	15.71
16	Planter's Friend	75	9.33	6.67
18	Late Orange	99	15.15	6.06
20	Colman Cane	93	21.51	12.90
22	Sterling (Kansas), Lot No. 161, 1890	70	18.57	11.43
28	Colman Cane (Kansas), 1890	156	12.18	3.21

The figures of Table II make evident the chemical superiority of the first series. In using these data for singling out the varieties which have given the best results this season, due weight was given in the case of Early Orange, Collier's, and Colman Cane to the average sample analyses obtained from canes grown in the field Plats A, B, and D, of which a detailed account is given later (in Table III), and which influenced the choice of varieties for another year in no little degree.

AVERAGE SAMPLE RESULTS.

The four average sample plats have already been described, and represented the varieties Early Orange, Collier's, Link's Hybrid, and Colman Cane, respectively; that Plat C failed to germinate, and that Plat A was planted with and treated like the forage sorghum, being damaged in consequence, will be recalled. Plats B and D stand on the same footing with the single-head plats of the first series as to treatment, etc.

In the subjoined Table III are given in full all the analyses made upon

the Plats A, B, and D, and upon samples from the row of forage sorghum adjacent to A. The column headed "Solids" gives the degree brix corrected for temperature; "Purity" expresses the per cent ratio of sucrose to solids. The ratio of glucose to sucrose is not considered of enough importance in this work to be calculated; in its stead is given the ratio of nonsugars to sucrose. "Nonsugars" is the name given to the juice-solids not sucrose or glucose, and, of course, is the numerical difference between the per cent solids and the sum of sucrose and glucose.

Samples were uniformly of ten consecutive canes, and were taken at weekly intervals, except in one or two cases.

TABLE III.—*Summary of average sample analyses, 1891.*

PLAT A.—EARLY ORANGE.

Serial No.	Date.	No. days from planting.	Solids.	Sucrose.	Purity.	Glucose.	Nonsugar.	Nonsugar ratio.	Marc.	Juice.
4	Oct. 20	145	16.4	12.9	78.7	1.5	2.0	15.5	.....	.....
9	Oct. 27	152	16.8	13.0	77.4	1.3	2.5	19.2	.....	.....
10	Oct. 27	152	13.5	9.1	67.5	1.7	2.7	19.7	.....	.....
16	Sept. 3	159	14.8	10.0	67.6	2.4	2.4	24.0	.....	.....
20	Sept. 5	161	14.3	9.3	65.0	2.7	2.3	24.7	10.95	89.05
24	Sept. 10	166	14.7	8.5	57.8	3.0	3.2	37.6	8.62	91.38
28	Sept. 17	173	14.0	9.0	64.3	1.6	3.4	37.8	.....	.....
36	Sept. 24	180	14.9	9.7	65.1	2.3	2.9	29.9	.....	.....
43	Oct. 1	187	13.9	8.9	64.0	1.3	3.7	41.6	8.43	91.57
50	Oct. 8	194	13.4	8.3	61.9	2.0	3.1	37.3	.....	.....
Average			14.7	9.7	66.0	2.0	3.0	30.9	9.33	90.67
Maximum			16.8	13.0	77.4	3.0	3.7	41.6	10.95	91.57
Minimum			13.4	8.3	57.8	1.3	2.0	15.5	8.43	89.05

PLAT B.—COLLIER'S.

2	Aug. 10	135	19.4	14.5	74.7	1.1	3.8	26.2	.....	.....
6	Aug. 20	145	22.6	17.9	79.2	1.1	3.6	20.1	.....	.....
11	Aug. 27	152	22.6	18.4	81.4	.6	3.6	19.6	.....	.....
17	Sept. 3	159	21.7	17.8	82.0	.7	3.2	18.0	.....	.....
25	Sept. 10	166	22.5	17.3	76.9	.7	4.5	26.0	.....	.....
29	Sept. 17	173	22.5	17.8	79.1	.6	4.1	23.0	.....	.....
37	Sept. 24	180	21.8	17.0	78.0	.8	4.0	23.5	.....	.....
44	Oct. 1	187	20.4	15.6	76.5	.7	4.1	26.3	.....	.....
51	Oct. 8	194	17.6	12.4	70.5	.7	4.5	36.3	.....	.....
Average			21.2	16.5	77.8	.8	3.9	23.6	.....	.....
Maximum			22.6	17.9	82.0	1.1	4.5	36.3	.....	.....
Minimum			17.6	12.4	70.5	.6	3.2	19.6	.....	.....

PLAT D.—COLMAN CANE.

3	Aug. 10	135	16.7	12.3	73.7	1.5	2.9	23.6	.....	.....
7	Aug. 20	145	20.1	15.7	78.1	1.6	2.8	17.8	.....	.....
12	Aug. 27	152	19.6	15.2	77.6	1.6	2.8	18.4	.....	.....
18	Sept. 3	159	21.3	17.3	81.2	.9	3.1	17.9	.....	.....
21	Sept. 5	161	21.0	16.5	78.6	.8	3.7	22.4	10.10	89.90
26	Sept. 10	166	21.8	17.2	78.9	.9	3.7	21.5	9.66	90.34
30	Sept. 17	173	23.2	18.9	81.5	.6	3.7	19.6	.....	.....
38	Sept. 24	180	22.5	18.1	80.4	.9	3.5	19.3	.....	.....
45	Oct. 1	187	20.9	16.7	79.9	.9	3.3	19.8	10.41	89.59
52	Oct. 8	194	20.0	15.0	75.0	.9	4.1	27.3	.....	.....
Average			20.7	16.3	78.7	1.1	3.3	20.2	10.06	89.94
Maximum			23.2	18.9	81.5	1.6	4.1	27.3	10.41	90.34
Minimum			16.7	12.3	73.7	.6	2.8	17.8	9.66	89.59

TABLE III.—*Summary of average sample analyses, 1891*—Continued.

(FORAGE) RED LIBERIAN.

Serial No.	Date.	No. days from planting.	Solids.	Sucrose.	Purity.	Glucose.	Nonsugar.	Nonsugar ratio.	Marc.	Juice.
5	Aug. 20	145	14.7	6.1	41.5	5.9	2.7	44.3	.....	.....
13	Aug. 27	152	16.9	11.0	65.1	4.1	1.8	16.4	.....	.....
22	Sept. 5	161	16.5	9.5	57.6	4.5	2.5	26.3	.....	.....
27	Sept. 10	166	17.5	11.8	67.4	2.8	2.9	24.6	.....	.....
31	Sept. 17	173	17.4	9.8	56.3	3.8	3.8	38.8	.....	.....
35	Sept. 24	180	16.6	10.8	65.1	3.4	2.4	22.2	.....	.....
42	Oct. 1	187	17.1	10.9	63.7	3.8	2.4	22.0	.....	.....
49	Oct. 8	194	13.5	6.4	47.4	4.2	2.9	45.3	.....	.....
Average			16.3	9.5	58.9	4.1	2.7	26.3	.....	.....
Maximum			17.5	11.8	67.4	5.9	3.8	45.3	.....	.....
Minimum			13.5	6.1	41.5	2.8	1.8	16.4	.....	.....

Early Orange falls very far below its usual average, being scarcely better, except in purity, than the Red Liberian field sorghum with which it was grown. It is very probable that the intentional lack of care it experienced in planting and cultivation is mainly responsible, for while this plat (A) was very badly injured by the season, yet it was from the same stock as single head plat No. 1, and should have made nearly as good a showing had its conditions of growth been comparable. The history of this plat is suggestive, in view of the too common attempts which have been made to raise fields of sorghum for sugar production without bestowing the care and attention which such a crop should have.

The showing made by Collier's and Colman Cane in Table III is a long step in advance of the progress hitherto made by any varieties tried upon Calumet. Between August 10 and October 8 both these varieties maintained a sucrose content and purity which would almost have allowed profitable working of the juice by ordinary sugar-house processes.

In all varieties the nonsugars are quite as high as in former seasons, and it seems that any considerable breeding out of what is apparently so fundamental a constituent of sorghum juices will prove possible, if at all, only after years of intelligent and painstaking endeavor.

Tables IV and V embody the outcome of the experiments of this and the two preceding years; from the varieties therein listed are selected those upon which future culture will be principally centered as their continued merit in the past gives them precedence over any other varieties which may be introduced later.

TABLE IV.—*Varieties, in order of merit, which have been noted in field and laboratory for the various qualities named, during the experiments carried on in the season of 1891 at Calumet.*

BEST SIX IN 1891.

	High sucrose.	High purity.	Low, nonsugar.	Best seed.	Large canes.
Best	Collier's.....	Collier's.....	Late Orange	Colman Cane....	Ubehlana.
Second	Planter's Friend.	ImprovedOrange	Planter's Friend.	Early Orange ...	Colman Cane.
Third	Link's Hybrid..	Link's Hybrid ..	Colman Cane....	Link's Hybrid..	Early Orange.
Fourth....	Colman Cane ...	Early Orange...	Collier's	Planter's Friend.	Planter's Friend.
Fifth.....	Improved orange	Colman Cane....	Link's Hybrid..	Late Orange....	Late Orange.
Sixth	Ubehlana	Planter's Friend.	Early Orange...	Red Liberian ...	Link's Hybrid.

TABLE V.—*Varieties distinguished for valuable characters in course of three years' experiment in order of merit, two sets being made of canes grown three and two years, respectively.*

THREE YEARS' CULTURE ON CALUMET.

High sucrose.	High purity.	Low, nonsugar.	Best seed.	Large canes.
Improved Orange	Link's Hybrid	Late Orange	Link's Hybrid	Link's Hybrid.
Link's Hybrid	Improved Orange.	Early Orange	Early Orange	Early Orange.
Late Orange	Late Orange	Link's Hybrid		
Early Orange	Early Orange	Improved Orange.		

TWO YEARS' CULTURE ON CALUMET.

Collier's	Collier's	Collier's	Colman Cane	Ubehlana.
Colman Cane	Colman	Planter's Friend	Planter's Friend	Colman Cane.
Planter's Friend	Planter's Friend	Colman Cane		Planter's Friend.

From the two foregoing tables six varieties have been chosen as those which are judged fittest for continued trial: Colman Cane, Collier's, Planter's Friend, Link's Hybrid, Early Orange, Ubehlana.

SIZE OF SORGHUM STARCH GRANULES.

In a former report some space was devoted to the discussion of the influence of the contained starch upon the treatment of sorghum juices in the sugar manufactory, and a doubt was there expressed as to the practicability of mechanical filtration as a means for its removal from raw, unheated juices. Since then some data has been secured as to the size of the granules existing in the juice, and their excessive minuteness is confirmatory, in some measure, of the conclusion formerly reached. Samples of the starch obtained by settling and repeated washing and decantation from both the juice and the bruised seed were collected and submitted to Dr. W. H. Sylvester, of Natick, Mass., who had kindly offered to make a microscopic examination of them; and the following results were reached, measurements of starch granules from other sources being made at the same time for comparison's sake:

	Inch diameter.
Sorghum seed (average of many grains)	$\frac{1}{2000}$
Sorghum juice	$\frac{1}{8000}$ to $\frac{1}{6000}$
Tout le mois	$\frac{1}{3000}$ to $\frac{1}{2000}$
Potato	$\frac{1}{5000}$ to $\frac{1}{4000}$
Maize	$\frac{1}{8000}$ to $\frac{1}{4000}$

Respecting the starch from sorghum juice he says:

This latter is the smallest starch grain I ever saw. With 500 diameters the grains are but mere specks. * * * Blood corpuscles will average but $\frac{1}{3200}$-inch. It would seem as though the grains must be immature or in an undeveloped condition, as they do not show any evidence of marking. * * * It seems that it is more the starch of green vegetation than of ripe. The canes from which this starch was procured, nevertheless, were such as by outward signs, as well as chemical analysis, would be considered fully ripe enough for manufacturing purposes.

Respectfully submitted.

F. E. COOMBS,
Chemist.

CULTURAL WORK AT STERLING.

By A. A. Denton.

(Analytical work by Hurbert Edson and Jno. L. Fuelling.)

In continuing the experimental work with varieties of sorghum at Sterling, Kans., 130 acres of land was leased on four farms, distant from 1 to 2 miles from each other and from the station.

The soil on these farms varied from sandy to hard clay, and these differences affected results, as will be noted later. Fifteen acres had been well plowed the previous fall, the soil was in good condition at planting time, the seeds germinated sooner and more evenly, the canes ripened sooner and more nearly at the same time, and the analyses were more uniform than on dry soil plowed at time of planting. Fifteen acres were subsoiled, the ordinary plow being followed by a subsoil plow. No benefit was noted from subsoiling. Varieties of sorghum planted on well-plowed land, not subsoiled, succeeded as well as the same varieties planted on adjacent land, which was not subsoiled. It is said that subsoiling is done to best advantage in the fall. It is also said that benefit from subsoiling is seen in following years. Probably much depends upon the subsoil and upon the season. It requires experiments to determine the best methods for various soils. Twenty-five acres had not been cultivated the previous season, the soil was dry and hard and was plowed with difficulty, and this, or other causes affected the crop.

Six hundred plats were planted with varieties of sorghum, or with selections from the best varieties made the previous year; 31 plats were planted with seeds received from foreign countries; 33 plats, containing very nearly 1 acre each, were planted with the varieties which had given best results in previous years at this station. The object of planting these larger lots was to get the average value of each variety in larger lots by more frequent analyses of larger samples of cane than could be done with smaller lots, to have an ample supply of cane for extended seed selection from the best varieties, and to secure sufficient seed of the best varieties for distribution by the Department of Agriculture. Seventy-two lots were planted in crosses, which had been selected from those grown the previous year as worthy of further trial.

Special effort was made to plant all the varieties as nearly as possible at one time. Earlier or later planting sometimes affects results of any crop, favorably or unfavorably, according to the season. Planting varieties at the same time facilitates comparison of analyses by placing them more nearly in like conditions. It is quite likely that the planting was unduly hurried, and that it would have been better to give it more time.

In planting varieties, consideration was given to the varying condition of the soil. Selections from the best varieties were planted on each of the four farms. Each variety was planted on sandy soil and also on clay. It is believed a more correct general analysis of each variety can be obtained from a number of plats planted on different soils. In wet

weather cane grows best on clay soil; in dry seasons it succeeds best on sandy soil, as has been shown by work at this station in 1888, '89, '90, and '91. In this year canes grew much better on clay soil in the month of June, which gave 4.83 inches of rain, and in July, which gave 6 inches of rain, than the canes on sandy soil. But the canes on sandy soil succeeded best in August, which gave but .75 inch of rain, and in September, which was also dry. Many varieties on clay soil which had made unusual growth during the wet weather were injured in the dry weather, while the varieties on sandy soil were fresh and vigorous in the driest weather. It would have been much more convenient if all the selections of one variety had been planted in one part of one field, but by so doing the general analysis of that variety would have been higher or lower, as the conditions in that place were more favorable or unfavorable than average conditions.

Many selections from the best varieties were planted. For instance, forty-five lots of the Collier variety were planted, including two 1-acre lots. The object of planting so many lots of one variety with seeds from selected canes, whose juices had high percentages of sugar, was to secure seed from the most successful lot. All canes which have rich juice have not the power of producing canes of similar quality. When one such cane has been found an improvement is made at once in that variety. For instance, Folger's Early, in 1888 and 1889, was a 10 per cent variety. Its juice contained on an average 10 per cent of sugar. By a single selection of seed from a superior cane, made in 1888 and planted in 1889, that variety became a 12 per cent variety, and in the three years succeeding the selection its descendants have retained its quality. In 1888 Planter's Friend was a 12 per cent variety. Thirty selections of canes having 14 to 15 per cent of sugar were made in that year. But one of these selections produced canes which retained that percentage of sugar. The descendants of the successful selection have retained its quality in three years succeeding the selection. By planting the seeds from many superior canes of one variety in as many separate lots, and by selecting seed from the best canes which grow in the best one of these lots, it is believed that a variety may be quickly and permanently improved. The planting of the experimental field was planned on this basis.

The lots planted with seeds from a single cane were planted by hand. The acre lots were planted with a drill. As was observed in 1888, '90, and '91 machine planting was best. The seeds germinated sooner and more evenly. In a dry spring hand planting is unsatisfactory. There seems, however, to be no better way to plant small lots with seeds of varying size. None of the lots planted by hand required thinning, for the right number of seeds were dropped. On the acre lots the machine was regulated to plant 2 pounds of seed per acre. Nearly all of these lots required to be thinned. Two pounds of sorghum seed is a rather indefinite quantity, so far as number of seeds is concerned, for there are from

20,000 to 30,000 seeds in a pound. Assuming that each seed produces a cane, this would give from 40,000 to 60,000 canes per acre. It is true that all the seeds do not produce canes, but it is also true that many seeds produce more than one cane for sorghum tillers; that is, produces more than one cane from one root. If 24,000 canes, weighing, when trimmed of seed top and leaves, 1 pound each, or 12 tons of clean cane per acre, is a fair yield, it follows that 2 pounds of seed per acre is a liberal allowance. In all the work of this station it has been observed that canes which stand closely suffer most from drouth. In most seasons there are times when the plants need moisture. The tonnage or the yield of cane is not greater when thickly planted, except in seasons of abundant rain. In previous years the effort at this station has been to secure seed having 98 per cent vitality and to plant the seed carefully, so as to avoid the labor of thinning the plants to a proper stand. The conclusion has, however, been arrived at that it is economy to plant 2 pounds of seed per acre and to chop out superfluous plants after the dangers of the first cultivations have passed. This almost insures a regular stand of cane, without useless spaces or crowded canes.

On account of dry soil at the time of planting the seeds germinated irregularly and the canes were not uniform in ripening. In such seasons as 1890 and 1891 planting the seeds deeply, so they would be in moist earth, would give much better results than shallow covering with dry surface soil; but when the planting is followed by rains which compact the soil the reverse is true. As the weather can not be foretold there can be but one rule, which is to plant at moderate depth, avoiding the extremes of deep or shallow covering.

After the planting was finished the land was rolled. This smooths the surface and greatly assists in cultivating closely when the plants are small.

The experimental field received four cultivations and was hoed twice. The second hoeing was, perhaps, of slight benefit to the crop. Although the dry and cool weather of April and May was not favorable to rapid growth of cane, and the excess of rain in June and July was unusually favorable to growth of weeds, yet the cultivation of the experimental field was done more easily, cheaply, and better than in previous years. When the cultivation is done at the right times to secure mastery of the weeds, and when it is done in the best way, it is not more difficult to grow a good crop of cane than a poor one. In the work which has been done at this station the cultivation has been such as any farmer who trusts to good work rather than to luck can afford to give a crop of sorghum grown for sale to a sugar factory. It is well to know what the capabilities of sorghum are by intensive cultivation. It is also well to know what may be expected from sorghum when grown in a practical and general way.

In June and July there was excess of rain and the canes grew to unusual size. In August there was a marked deficiency of rainfall and the

rank growth of cane was in poor condition to withstand hot, drying winds and baked soil. Many of the varieties which were planted on hard soil were injured by dry weather.

The tonnage or yield of cane was large, being equaled only by that of 1889. The average quality of the juice was good, as is shown in the general averages given to each variety. In some of the varieties the quality of juice was not as good as in the more favorable season of 1889. The varieties which usually mature early matured later than in any previous season. Their juice had low purities until late in the season. The early and the late varieties matured nearly at the same time. These facts can be explained only as the effect of drought upon the unusually rank growth of June and July, for the weather in 1890 was as dry as in 1891, at the same season, and had not the same effect upon the smaller canes of that season.

The object of the work at this station is, first, to select the varieties best suited to sugar manufacture, so that all other varieties may be discarded; and, second, to improve the selected varieties by selection of seed from the best canes. In order to select the best varieties it is necessary to learn the practical value of each variety during its working season. A single analysis of a variety is of little value. The mean of many analyses of a single lot may mislead. In the work which has been done this season an effort has been made to arrive at the value of each variety by grouping together all the maximum analyses of all the lots of each variety which were grown here this season, and also by grouping together the analyses of each variety in the four years in which the experimental work has been carried on at this station. In endeavoring to express the value of the Collier variety, for instance, a single analysis of a sample of the cane may have shown 18 per cent of sugar. The mean of all the analyses of a single lot of that variety may have shown 17 per cent of sugar, but the mean, or the general average, of two hundred and forty-two analyses of canes from sixty-five lots of that variety, which were made in 1888, 1889, 1890, and 1891, shows that its juice contains, on an average, 14 per cent of sugar during a working period of twenty-five days. It may be called a 14 per cent variety. As its yearly average has not varied 1 per cent above or below that figure for four years, it may be assumed that it will continue to have that value. From the results of two hundred and six analyses of Colman cane in four years it may be said that it also is a 14 per cent variety. The McLean variety, as the result of seventy-five analyses in two years, may be hoped to prove to be a 15 per cent variety. Early Orange may thus be considered a 12 per cent variety, and Early Amber an 11 per cent variety.

These figures may seem low, for the Amber sometimes reaches 14 per cent, the Orange 15 per cent, the Collier, the McLean, and the Colman sometimes reach 18 per cent; but general averages for a proper working period are always low, and it is upon general averages that manufacture depends.

Two thousand six hundred and seventy-two analyses of the juice from average samples of cane were made this season. It is, of course, necessary that the samples of cane taken for analysis should be so taken as to lead to correct conclusions in regard to the value of the lot from which they were taken. There are difficulties in taking such samples. The canes in one lot may not be uniformly mature. One part of the lot may have been injured by drought, by frost, by wind, or by hail. One part of a lot may be on good soil, while a part may be upon unsuitable soil. A sample may do injustice to a variety or it may promise too much for the variety. In taking samples of cane for analysis at this station the effort has been to have the samples correctly represent the normal canes of the variety from which they were taken. When canes have been accidentally injured, as by stock or frost or other cause, they have not been included in the sample. In such cases the intention has been to have the sample represent the normal canes.

The object of the work is simply to compare the varieties under as similar conditions as possible; obviously it would tend to defeat this purpose of the comparison if accidentally injured canes were compared with ordinary canes. In order to check the methods of taking samples many hundred large samples were taken during the season and were ground in a two-horse mill, and comparative analyses of the larger and smaller samples were made. To test the method of taking samples still further, from three to five large samples were taken at one time from as many different places in one lot of each of the best varieties. The mean of these samples from the same lots represented as nearly as may be the value of the canes in those lots. The analyses of the juices of single canes for seed selection also confirm the analyses of average samples, low averages giving low selections and high percentages in average samples giving high percentages in seed selections, as will be seen in the analyses of each variety.

Twenty-six thousand six hundred and thirty-five polarizations of juice from single canes were made for the purpose of selecting seed from the best canes. A first selection was made by rejecting juices whose density was not unusually high. About 100,000 canes were thus separately tested, 26,635 samples of juice being accepted for analysis. From these a third selection, based on high percentage of sugar, was made, and from these a final selection, based on high purity, was made, whose juice had high density, high percentage of sugar, and high purity. In studying these seed selections it will be observed that the purity, with few exceptions, follows the percentage of sugar. Perhaps the readiest way of increasing the purity of sorghum juice consists in increasing the percentage of sugar. There appears to be a double gain in sugar by selecting varieties and by improving varieties; a gain in percentage of sugar and a gain in purity, in effect a double gain in yield of sugar. Twenty-six thousand six hundred and thirty-five seed heads were se-

lected. From these 7,827 were selected whose juices had a mean value of 15.98 sucrose, 73.78 purity. From these were selected 1,658 whose juices had a mean value of 16.41 sucrose, 76.84 purity.

In the 26,635 selections, 5,905 contained between 15 and 16 per cent of sugar, 5,296 contained between 16 and 17 per cent, 2,550 contained between 17 and 18 per cent, 172 contained between 18 and 19 per cent, and 23 had 19 per cent and more.

These figures serve to show the capabilities of the sorghum plant. The general averages given for the varieties in four years serve to show what the sorghum plant now is.

There is a general belief that seeds from canes which have an extraordinary percentage of sugar are most desirable for planting, with a view to producing rich canes. It is perhaps well to quote the opinion of the veteran seedsmen, Vilmorin, Andrieux et Cie., of Paris:

> As far as our experience goes it does not seem to be the safest way to discard merely superior plants, and to give preference only to those having extraordinary quality. On the contrary, it is often the case that merely superior plants afford the surest means of rapidly improving the variety. This applies especially to the most important quality—the capability of transmitting their good qualities to their descendants; and as this quality can not be ascertained at the outset, it is necessary not to be oversevere in the first selection.

If this opinion is correct, as it probably is, when endeavoring to improve a 14 per cent variety of sorghum, it is safer to plant seeds from 15 per cent canes than from 19 per cent canes; that is, the lower class of selections is worth more than the higher.

In making selection of seed, canes were taken only from those varieties which gave the best results in average analyses. The largest canes were selected in the field, and the smaller canes were thrown out by a second selection at the mill, so that selections of seed were made first from the best varieties; second, from the largest canes; third, from canes whose juice showed in analysis an unusually high percentage of sugar; fourth, from canes whose juice had exceptionally high purity. Another selection, based upon early ripening canes, was also made. In many of the central States there are frequent inquiries for "varieties which mature not much later than Amber." It is believed that the time of maturing of the varieties can be hastened by selecting seed from the canes which show a good percentage sooner than average canes, and that superior varieties may thus become well suited to more northern latitudes. For instance, many single canes in the Folger variety showed 15 per cent of sugar two weeks sooner than the majority of the canes of that variety. In many, perhaps in most, of these cases, the difference in time of maturing was only accidental, but if a single seed head can be obtained from a cane which naturally matures two weeks earlier than the Folger, a valuable subvariety can soon be established, and a point will be made in favor of that variety. In this selection 2,800 seed heads were reserved from five varieties for future planting.

In 1890 455 lots were planted in crosses in the hope of finding a new

and possibly a superior variety. Sixty of these were considered worthy of further trial and were planted last spring. Three of these are now considered very promising new and distinct varieties, the size and the uniformity of the canes being considered in connection with the average analyses of the juice in 1890 and in 1891. Twelve crosses were also continued, which had given good results in 1888, 1889, and 1890.

The work which has been done in the last four years with varieties at this station shows that sorghum is not the fickle plant it is generally supposed to be. Few of the leading varieties have varied in their mean analysis for any year 1 per cent above or below their general average for four years. The varieties having high percentages of sugar have, when in fair conditions, always retained their high percentage of sugar. The varieties having low glucose have retained that quality, and the varieties having high glucose still retain it. The medium varieties have always beeen medium varieties.

In continuing the experimental work with varieties of sorghum, it is recommended that six of the best varieties be selected and studied, more particularly with reference to comparative values. The work at this station, so far, has been mainly a search for better varieties among a multitude of varieties. It is not recommended that work on new varieties should be discontinued, for the five varieties which have given best results all either originated at this station or were introduced by the station within the last four years, and the fact that the variety which has given the best results of all the varieties in two seasons was received from a foreign country in 1890, is sufficient evidence of the utility of this work.

It is also recommended that more special attention be given to the improvement of the selected varieties by seed selection. The selection of seed which has been made so far has been more in the line of securing pure seed by growing canes from selected seed heads. To show concisely what is desired, the results obtained by Prof. Maercker at Halle, Germany, in improving the sugar beet by selection of seed in ten years (1880–1889) are given here:

Summary giving average sugar content of beets grown at Halle Station.

	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.
Klein Wanzleben varieties:										
Percentage of sugar in juice	13.6	13.8	13.6	15.8	15.4	15.4	16.2	17.7	17.0	16.8
Purity	81.9	83.3	85.0	85.7	85.0	84.5	85.8	88.2	88.1	87.8
Vilmorin varieties:										
Percentage of sugar in juice	.....	14.8	15.8	16.8	16.6	16.2	17.0	18.3	17.6	17.8
Purity	.....	84.1	86.8	85.6	86.3	84.6	85.6	88.2	87.6	89.1

It is obvious that to arrive at such figures, correctly representing a corresponding improvement in varieties of sorghum, will require special attention to this line of work.

It is also recommended that the relation which exists between weight of cane and percentage of sugar be ascertained. It is obvious that there is a loss of weight in cane, which is a loss to the cane-grower and at the same time an increase in the percentage of sugar, which is a gain to the sugar manufacturer, caused by the drying of the canes after the canes have completed growth. There should be a correspondence between the weight of the canes, the percentage of sugar, and the price per ton of cane.

And it is recommended that consideration be given to the keeping qualities of cane of different varieties. The following analyses of five varieties, made in a period of twenty days after the canes were cut, shows that in some conditions, which are not now well understood, canes may be kept for a considerable time after they are cut without great loss of sugar. (See p. 99.)

In one instance at this station several thousand canes were kept five days without considerable loss of sugar, as was shown by comparison of analyses made the first and the fifth day. The same has also been observed, in one instance, in Louisiana, and in one instance at Attica, Kans. As this quality is of considerable importance to the cane-grower as well as to the sugar manufacturer, it would be well to investigate the conditions of ripeness, the weather, and the varieties, with reference to the keeping quality.

In this connection it may be said, that analysis of sorghum cane in this western country is sometimes influenced by the state of the weather. It is well known that in times of drought a rain immediately lowers the percentage of sugar, sometimes as much as 2 to 3 per cent. In these cases analyses made before the rain are of juices more or less inspissated, the analyses made after the rain are of juices more nearly in their normal condition, and these differences are very readily observed in the analyses.

It is also true that in very dry times there are differences in the analyses of canes cut in the morning or in the evening. This has been observed in three of the four years' work at this station. In the work this year many thousands of canes cut near the close of the day's work and analyzed singly showed constantly higher percentages of sugar than as many analyses of canes which were cut in the morning. This was repeated many times, and this fact which may appear singular to those in humid climates is perhaps due to the simple fact that in very dry times evaporation from the canes is more rapid during the heat of the day than the roots can supply from the scanty moisture in the soil, so that at evening the juices of the canes are partially desiccated, while in the morning they are more nearly in their normal condition, and these differences are notable in analysis, in some cases amounting to as much as 1 per cent; that is, a variety may show 14 per cent sugar in the morning and in the evening may show 15 per cent of sugar, the difference being simply due to evaporation of water from

the canes during the heat of the day. Acting on these observations, it is the rule at this station to cut all average samples of cane from varieties taken for analysis in the morning, and to cut the canes intended for seed selection in the afternoon, and to defer the cutting of cane for average samples for some time after a rain which follows a drought, otherwise the analyses are irregular.

The general belief that sorghum is fickle in its content of sugar may be traced to causes some of which may be removed. The causes of variation are: Seeds of mixed varieties, or even seeds of one variety, which are not bred to ripen at one time, differences in soil in one field, or careless agriculture, which causes the canes to ripen not uniformly, and differences in the density of the juices, caused by variations in the weather at the times analyses are made.

The varieties of sorghum which have given best results at this station may be classified as follows: The pounds of sugar actually contained in a ton of clean cane is given, in addition to the percentage of sugar in the juice, for the reason that many cane growers consider a difference of 1 per cent but a small matter, and because all readily understand what is meant by pounds of sugar per ton of cane. The values for the varieties are based upon the averages of all the analyses made upon the varieties, during reasonable working periods, including the years 1888, 1889, 1890, and 1891.

Variety.	Sucrose.	Sugar, per ton.
	Per cent.	
McLean's	15.30	269
Collier's	14.29	251
Colman's cane	14.24	250

It is not deemed worth while to state here the facts in regard to discarded varieties, to give rejected analyses, or results of useless work. The following list of varieties contains only those which are considered worthy of consideration in this place.

The results of four years' experimental work with varieties of sorghum at this station appear to indicate that sorghum is as stable in qualities as other plants are; that the varieties have definite qualities of juice which may be regarded as belonging to them, and which are as characteristic of them as is the type of the cane or the color of the seed; that at present it may be expected that the best varieties, in fair conditions of cultivation and of season, will yield juice which contains an average of 14 per cent of sugar; that is, 12.32 per cent of the weight of the cane, or 246 pounds of pure sugar per ton of cleaned cane; and the success of sorghum sugar manufacture appears to depend on the ability of the manufacturer to extract the sugar from such canes.

It is believed that the thousands of analyses which have been made of sorghum at this station justify the expectation that some varieties

may be developed which will contain 15 per cent of sugar in the juice, as an average working value, through a term of years. It is believed that four of the following varieties may become 15 per cent varieties:

EARLY AMBER.

This well-known variety is retained for the present, because it is believed to be unwise to discard it. The Folger variety is a better cane, retains its percentage of sugar longer, and ripened as soon as Amber this season; usually, however, it matures between Amber and Orange. The Amber is a small cane, does not produce an average amount of seed, and is less reliable in quality of juice than other varieties. Its juice has sometimes 14 per cent of sugar; but, as will be seen in the following general averages, its value is 11.93 for a working period of thirty days. No seed selections were made from this variety in 1888 or 1889. In 1890 many selections were made, only four of which gave satisfactory results. Twenty-one lots were planted, two being 1 acre each.

Early Amber.

[Average samples.]

	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
Mean for—			*Per cent.*	*Per cent.*	
1888	19	10	9.50	2.35	63.34
1889	28	25	11.69	1.25	73.94
1890	26	12	12.84	1.50	71.02
1891	29	20	12.90	1.53	72.20
Total		67	11.93	1.54	71.30
Mean of five best lots		6	13.98	1.51	74.41

MEAN VALUE OF SEED SELECTIONS.

[Total number of single canes analyzed, 964.]

No. of analyses.	Sucrose.	Purity.
	Per cent.	
459	13.74	71.98
67	14.87	75.27
17	15.27	76.69
1	15.60	76.80

McLEAN'S VARIETY.

[Variety 126—127.]

This new variety was received from Australia, in 1890, from Hon. Peter McLean, under secretary of agriculture, Queensland. As this variety was unnamed, it is now named "McLean," in recognition of his assistance in procuring new varieties. It has given the best results of any in the two years 1890 and 1891. It is a medium early maturing variety, and it is believed it will be adapted to Northern States. The canes are tall and rather slender, but are solid and woody, and have stood winds as well as any varieties so far. From the analyses it would seem that it would be difficult to make sirup instead of sugar from the

ripe canes, and Mr. Folger, of Washington, Iowa, reports such to be the case, boiling in an open pan. Thirteen lots were planted, three being 1 acre each.

McLean's variety.

[Average samples.]

	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
Mean for—			*Per cent.*	*Per cent.*	
1890	36	12	15.22	0.52	76.00
1891	28	12	16.40	0.55	77.40
Total		24	15.81	0.53	76.70
Mean of six best lots		6	17.15	0.50	77.90

MEAN VALUE OF SEED SELECTIONS.

[Total number of single canes analyzed, 4,730.]

No. of analyses.	Sucrose.	Purity.
	Per cent.	
1,620	17.26	75.86
201	17.85	78.96
77	18.32	79.25
5	19.10	82.44
1	19.40	85.40

COLMAN'S CANE.

This variety excelled in 1889 and was one of the best in 1890. All of the lots gave canes of good quality this season, except some which were ruined by drought, owing to some peculiarity of soil. It gives stocky canes of good size, when not planted too thickly, which mature at the same time as the Early Orange. It is considered one of the best varieties. Twenty-one lots were planted, two being 1 acre each.

Colman's cane.

[Average samples.]

	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
Mean for—			*Per cent.*	*Per cent.*	
1889	40	22	14.58	1.15	75.55
1890	36	45	14.88	0.84	76.38
1891	35	20	15.60	0.73	76.30
Total		87	14.51	0.90	76.15
Mean of six best lots		6	17.21	0.60	78.90

MEAN VALUE OF SEED SELECTIONS.

[Total number of single canes analyzed, 2,236.]

No. of analyses.	Sucrose.	Purity.
	Per cent.	
726	16.40	76.55
210	16.96	78.16
18	18.29	79.97
1	19.40	81.10

COLLIER'S VARIETY.

This variety was received from Dr. Collier, formerly chemist of the Department of Agriculture, in 1888, and has been grown at this station, giving good results in 1888, '89, '90, and '91. It is considered one of the best varieties. The canes are slender, with light seed top, and have always stood up well. It ripens medium early, and matured well in Iowa this season. In the seeds received in 1888 two varieties were mixed. These were separated in 1890, and have been known hitherto as Undendebule No. 1 and Undendebule No. 2. As, however, the varieties are distinct, the similarity of names causes confusion, and for this reason Undendebule No. 1 is now called "Collier," by request of Dr. H. W. Wiley, chief chemist of the United States Department of Agriculture and director of this station, as a mark of appreciation of the services rendered the sorghum industry by Dr. Collier. Forty-five lots of were planted, three of them containing 1 acre each.

Collier's variety.

[Average samples.]

	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
Mean for—			*Per cent.*	*Per cent.*	
1888	27	4	12.31	0.73	71.69
1889	26	17	14.91	0.75	76.95
1890	34	18	15.95	0.59	74.77
1891	24	43	14.80	0.90	73.80
Total	.....	82	14.95	0.78	74.56
Mean of four best lots	.....	4	17.55	0.75	78.67

MEAN VALUE OF SEED SELECTIONS.

[Total number of single canes analyzed. 3,077.]

No. of analyses.	Sucrose.	Purity.
	Per cent.	
1,186	16.97	74.70
261	17.69	77.21
48	18.78	77.61
11	19.10	77.64
1	19.40	78.20

FOLGER'S VARIETY.

This variety originated in a selection from Amber. It produces larger and better canes than Amber, the juice having a higher average percentage of sugar and retaining it much longer. This year it ripened as soon as Amber, but usually it ripens eight days later. Many selections of the first-ripened canes of this variety were made this season in the hope of obtaining a subvariety which will take the place of amber as an early maturing variety. The Folger is considered one of the best of the early maturing varieties. Twenty-nine lots were planted, three being 1 acre each.

Folger's variety.

[Average samples.]

	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
Mean for—			*Per cent.*	*Per cent.*	
1889	26	7	14.08	2.03	76.54
1890	50	32	14.12	1.75	74.91
1891	32	30	14.60	1.35	73.30
Total		69	14.32	1.44	74.37
Mean of three best lots		3	16.16	1.06	76.83

MEAN VALUE OF SEED SELECTIONS.

[Total number of single canes analyzed, 5,479.]

No. of analyses.	Sucrose.	Purity.
	Per cent.	
1,153	15.59	74.07
254	16.16	76.61
52	17.50	78.04
8	18.10	79.50
1	18.30	80.70

PLANTER'S FRIEND.

This variety was received from Australia in 1888. It produces handsome canes, not extra size. It is usually a late-ripening cane, maturing earlier this season than in previous years. Usually its last analysis before frost shows its highest percentage of sugar. It is believed this variety may be improved by selection until its general average gives 15 per cent. It was improved in 1889, by a single selection, from an average of 12.15 per cent to a general average of 14.49 per cent for the three years 1889, '90, and '91. Six lots were planted, one containing 1 acre.

Planter's Friend.

[Average samples.]

	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
Mean for—			*Per cent.*	*Per cent.*	
1888	36	4	12.15	1.78	65.39
1889	25	55	14.45	1.47	76.06
1890	33	6	14.57	1.88	71.49
1891	21	8	15.80	1.00	75.08
Total		73	14.49	1.46	74.99
Mean of three best lots		3	16.37	0.83	77.40

MEAN VALUE OF SEED SELECTIONS.

[Total number of single canes analyzed, 1,325.]

No. of analyses.	Sucrose.	Purity.
	Per cent.	
513	17.29	74.55
77	17.88	77.99
34	18.44	78.69
4	19.10	81.35
1	19.40	79.20

VARIETY NO. 112.

This variety, which originated in a selection made in 1888 from a field of the Honduras, but which has no resemblance to that variety, has given good results in the three years succeeding that selection. The canes are quite short and stocky, and ripen quite as early as the Folger variety. This year it gave better results in analysis than the Folger, having higher purity and a higher percentage of sugar. It is considered worthy of further work. Nine lots were planted.

Variety No. 112.

[Average samples.]

	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
Mean for—			*Per cent.*	*Per cent.*	
1889	25	20	14.23	1.08	76.42
1890	38	7	13.55	1.13	74.75
1891	14	9	15.00	0.74	73.70
Total		36	14.32	1.00	75.41
Mean of three best lots		3	16.53	0.50	76.00

MEAN VALUE OF SEED SELECTIONS.

[Total number of single canes analyzed, 220.]

No. of analyses.	Sucrose.	Purity.
	Per cent.	
75	14.87	73.05
9	15.38	76.59
3	15.93	78.16
1	16.00	79.60

VARIETY NO. 161.

This variety, which originated in a cross of Amber and Link's Hybrid, in 1888, has always been remarkable for its low percentage of glucose, it being always less than 1 per cent, and in frequent analyses only a trace. More reversions or variations were observed in these lots this year than last. Its canes are tall and slender. Its percentage of sugar and of glucose has been remarkably constant in three years; twenty-six lots were planted in this variety. It is believed that a uniform new variety, ripening nearly as early as Amber, remaining good longer and superior to it in all respects, can be developed from this selection, but the slenderness of the canes is objectionable.

Variety No. 161.

[Average samples.]

	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
Mean for—			*Per cent.*	*Per cent.*	
1889	43	18	13.24	0.45	77.33
1890	52	38	14.03	0.67	75.92
1891	29	18	14.60	0.81	74.80
Total		74	13.97	0.65	75.99
Mean of three best lots		3	16.23	0.50	77.10

MEAN VALUE OF TOTAL SELECTIONS.

[Total number of single canes analyzed, 551.]

No. of analyses.	Sucrose.	Purity.
	Per cent.	
246	15.37	75.10
58	16.22	77.27
3	17.40	77.56
1	17.90	77.90

EARLY ORANGE.

This well-known variety has been grown for four years at the station. It has been quite uniform in type and in quality of cane. It has had an average of 12.11 per cent of sugar in the juice in the three years, 1889, 1890, and 1891. It has always comparatively high glucose. Ten lots were planted.

Early Orange.

[Average samples.]

	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
Mean for—			*Per cent.*	*Per cent.*	
1888	17	12	10.40	2.80	62.93
1889	25	24	12.12	2.52	70.55
1890	32	5	13.50	2.15	72.08
1891	15	9	13.60	2.24	68.20
Total		50	12.11	2.49	68.45
Mean of three best lots		3	16.43	1.30	75.16

MEAN VALUE OF SEED SELECTIONS.

[Total number of single canes analyzed, 306.]

No. of analyses.	Sucrose.	Purity.
	Per cent.	
134	16.06	74.31
14	17.08	76.35
1	17.80	80.50

GOLDEN ORANGE.

Produces large and handsome canes. It reaches its maximum of sugar late in the season. Six lots were planted in this variety, one containing 1 acre. All the lots were materially injured by drought.

Golden orange.

[Average samples.]

	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
Mean for—			*Per cent.*	*Per cent.*	
1889	31	15	12.48	2.04	72.60
1890	46	17	13.56	1.70	72.64
1891	14	6	13.80	0.88	72.00
Total		38	13.17	1.70	72.52

No seed selections made.

CHINESE IMPHEE.

These canes are tall and slender, which is objectionable. This variety has always had a fair percentage of sugar and low glucose.

Chinese Imphee.

[Average samples.]

	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
Mean for—			*Per cent.*	*Per cent.*	
1889	27	6	13.81	0.61	76.38
1890	27	4	14.03	0.73	74.90
1891	33	2	14.10	1.10	69.00
Total	.....	12	13.92	0.73	74.65

MEAN VALUE OF SEED SELECTIONS.

[Total number of single canes analyzed, 43.]

No. of analyses.	Sucrose.	Purity.
	Per cent.	
29	16.50	74.08
9	17.20	76.00
1	17.70	77.00

BLACK AFRICAN.

This variety has been quite uniform in quality for three years. It ripens medium early; the canes are tall, which is not an advantage.

Black African.

[Average samples.]

	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
Mean for—			*Per cent.*	*Per cent.*	
1889	44	11	14.24	0.81	76.32
1890	46	17	13.36	1.32	70.72
1891	32	4	14.80	1.25	73.70
Total	.....	32	13.84	1.13	72.76
Mean of two best lots	.....	2	15.25	1.25	74.95

MEAN VALUE OF SEED SELECTIONS.

[Total number of single canes analyzed, 952.]

No. of analyses.	Sucrose.	Purity.
	Per cent.	
360	15.97	75.15
179	16.35	76.83
50	17.38	77.11
5	18.23	77.22
1	18.60	76.60

UBEHLANA.

This variety produces remarkably large and stocky canes, with light seed tops. It does not, however, seem to be well rooted, having blown down more or less each year. It has had a constant 12 per cent of sucrose, with high glucose, for four years. The canes rarely show 14 per cent of sugar.

No selections.

Dendemuka.

[Average samples.]

	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
Mean for—			*Per cent.*	*Per cent.*	
1889	28	11	12.20	1.19	72.78
1890	34	4	13.46	1.47	71.44
1891	18	2	13.90	1.23	71.60
Total	.....	17	12.70	1.29	72.32

MEAN VALUE OF SEED SELECTIONS.

[Total number of single canes analyzed, 13.]

No. of analyses.	Sucrose.	Purity.
	Per cent.	
5	16.10	71.22
2	16.40	71.75
1	16.80	72.40

VARIETY NO. 91.

This new variety, which originated in a cross of the White Mammoth and Kansas Orange in 1888, will, it is believed, become one of the leading varieties. The canes are large and have the erect habit of the White Mammoth. They have stood winds better than any other variety. The yield of cane per acre is as large as can be expected of any variety which matures in seasonable time in this latitude.

It has always had a fine percentage of sugar. Ten lots were planted, two being 1-acre lots. The general averages for 1890 and 1891 only are given, for but one analysis was taken in 1889. The last analyses of this variety have always been the best, and it is believed that the average analysis for this year would have given 15 per cent of sugar if frost had come at usual time.

Variety No. 91.

[Average samples.]

	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
Mean for—			*Per cent.*	*Per cent.*	
1890	21	9	15.69	0.84	76.47
1891	20	74	14.01	1.18	72.35
Total	.....	83	14.85	1.01	74.42
Mean of three best lots	28	21	14.45	1.13	72.80

MEAN VALUE OF SEED SELECTIONS.

[Total number of single canes analyzed, 723.]

No. of analyses.	Sucrose.	Purity.
	Per cent.	
219	15.26	73.23
29	15.77	76.51
6	16.45	76.76
1	17.60	75.50

UNDENDEBULE NO. 2.

The canes of this variety are much larger than those of the Collier, (until now known as Undendebule No. 1). The seed tops are also much larger. Otherwise these varieties, which were included in one package of seed received by Dr. Collier from Natal, Africa, in 1881, are quite similar.

Undendebule No. 2.

[Average samples.]

	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
Mean for—			*Per cent.*	*Per cent.*	
1890	34	11	13.64	1.13	71.78
1891	21	11	14.30	0.92	72.99
Total		22	13.97	1.02	72.39
Mean of three best lots		3	15.73	0.60	75.50

MEAN VALUE OF SEED SELECTIONS.

[Total number of single canes analyzed, 12.]

No. of analyses.	Sucrose	Purity.
	Per cent.	
7	16.64	73.39
4	17.00	74.30
1	17.00	76.30

LINK'S HYBRID.

This well-known variety has been considered one of the best for sugar-making. As it may be called a standard variety, a very large amount of work has been done upon it, upon selections, and upon crosses. It is believed that the following figures correctly represent the practical value of the variety during a working period of thirty days:

Link's Hybrid.

[Average samples.]

	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
Mean for—			*Per cent.*	*Per cent.*	
1888	33	25	13.02	1.06	72.09
1889	28	62	15.16	0.65	79.00
1890	33	160	13.37	1.15	71.77
1891	22	87	14.85	0.83	73.35
Total		334	14.09	0.97	73.57
Mean for six best lots		61	16.90	0.71	76.91

Seed selections, total number, 124.

SELECTIONS FROM LINK'S HYBRID.

Ten lots were planted from selections of this variety since 1888.

Selection No. 174.

[Average samples.]

	No. of variety.	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
				Per cent.	*Per cent.*	
Mean for—						
1888	940	.....	Single cane.	13.07	.....	70.08
1889	174	35	7	13.37	0.91	74.84
1890	34	45	9	13.80	1.02	72.96
1891	27	14	1	17.40	0.60	76.00
Total	.....	.....	18	13.79	0.95	73.70

MEAN VALUE OF SEED SELECTIONS.

[Total number of single canes analyzed, 97.]

No. of analyses.	Sucrose.	Purity.
	Per cent.	
71	17.21	73.24
15	18.00	74.45
1	18.70	77.60

Selection No. 165.

[Average samples.]

	No. of variety.	Days.	No. of analysis.	Sucrose.	Glucose.	Purity.
				Per cent.	*Per cent.*	
Mean for—						
1888	2007	.....	Single head.	15.30	.....	73.38
1889	165	32	5	15.08	.88	77.38
1890	58	50	8	14.20	1.34	71.35
1891	28	30	1	16.60	.80	75.50
Total	.....	.....	15	14.72	1.11	73.77

MEAN VALUE OF SEED SELECTIONS.

[Total number of single canes analyzed, 36.]

No. of analyses.	Sucrose.	Purity.
	Per cent.	
16	15.44	71.36
1	16.30	74.30

Selection No. 163.

[Average samples.]

	No. of variety.	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
				Per cent.	*Per cent.*	
Parent head, 1888	2,021	.....	1	16.10	.....	74.36
Mean for—						
1889	163	27	5	15.21	0.72	77.77
1890	35	43	9	13.78	1.17	71.87
1891	30	30	1	15.70	0.40	75.50
Total	.....	.....	16	14.49	0.96	74.09

MEAN VALUE OF SEED SELECTIONS.

[Total number of single canes analyzed, 493.]

No. of analyses.	Sucrose.	Purity.
	Per cent.	
43	15.84	72.56
16	16.10	73.09
4	16.66	74.35
1	17.20	74.80

Selection No. 162.

[Average samples.]

	No. of variety.	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
				Per cent.	*Per cent.*	
Parent head, 1888	2,110			15.57		73.61
Mean for—			1			
1889	162	41	8	14.75	0.63	78.85
1890	50	45	7	12.20	1.02	71.57
1891	79	25	1	15.40	1.00	74.10
Total			17	13.78	0.82	75.85

MEAN VALUE OF SEED SELECTIONS.

[Total number of single canes analyzed, 128.]

No. of analysis.	Sucrose.	Purity.
	Per cent.	
55	15.96	74.10
9	16 59	75.35
5	16.66	75.34

Selection No. 5x.

[Average samples.]

	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
Mean for—			*Per cent.*	*Per cent.*	
1890	38	7	14.28	0.62	72.33
1891	23	2	15.80	0.50	77.05
Total		9	14.50	0.59	73.37

Selection No. 8x.

[Average samples.]

	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
Mean for—			*Per cent.*	*Per cent.*	
1890	26	9	14.88	0.86	74.98
1891	19	2	15.95	0.35	76.00
Total		11	15.07	0.76	75.16

MEAN VALUE OF SEED SELECTIONS.

[Total number of single canes analyzed, 255.]

No. of analysis.	Sucrose.	Purity.
	Per cent.	
139	16.24	73.83
32	16.50	76.15
9	17.12	74.95
4	17.25	74.95
1	17.30	76.60

Selection No. 116.

[Average samples.]

	No. of variety.	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
				Per cent.	*Per cent.*	
Parent head, 1888	2116		1			73.00
Mean for—				14.31		
1889	116	35	7	14.61	0.65	80.76
1890	61	44	8	13.49	1.20	71.83
1891	22	30	1	16.60	1.20	75.50
Total			17	14.18	0.96	75.79

MEAN VALUE OF SEED SELECTIONS.

[Total number of single canes analyzed, 72.]

No. of analyses.	Sucrose.	Purity.
	Per cent.	
16	15.35	73.19
5	15.72	74.00
1	15.90	75.40

Selection No. 30.

[Average samples.]

	No. of variety.	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
				Per cent.	*Per cent.*	
Parent head, 1889			1	16.05		
Mean for—						
1890	30	51	9	13.24	1.05	72.59
1891	31	34	1	15.70	.40	75.50
Total			11	13.79	.98	72.88

MEAN VALUE OF SEED SELECTIONS.

[Total number of single canes analyzed, 84.]

No. of analyses.	Sucrose.	Purity.
	Per cent.	
52	16.45	74.39
5	17.20	76.50
1	17.60	77.60

Selection No. 153.

[Average samples.]

	No. of variety.	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
				Per cent.	*Per cent.*	
Parent head, 1888	2009	.....	1	15.34	.....	70.85
Mean for—						
1889	153	36	11	14.63	0.75	76.75
1890	43	30	4	13.75	0.70	74.19
1891	32	37	1	15.60	.....	76.83
Total	.....	.....	17	14.52	.74	75.80

MEAN VALUE OF SEED SELECTIONS.

[Total number of single canes analyzed, 126.]

No. of analyses.	Sucrose.	Purity.
	Per cent.	
110	16.66	73.62
13	17.43	74.62
3	17.93	75.43
1	18.20	76.10

Selection No. 66.

[Average samples.]

	No. of variety.	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
Parent head, 1889	Record lost.			*Per cent.*	*Per cent.*	
Mean for—						
1890	66	50	8	14.34	0.84	72.75
1891	21	23	1	16.00	0.80	75.10
Total	.....	.....	9	14.52	.84	73.01

MEAN VALUE OF SEED SELECTIONS.

[Total number of single canes analyzed, 1,301.]

No. of analyses.	Sucrose.	Purity.
	Per cent.	
458	14.86	73.32
37	16.22	73.25
7	17.15	77.35
1	17.50	76.80

Selection No. 172.

[Average samples.]

	No. of variety.	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
				Per cent.	*Per cent.*	
Parent head, 1888	944	.....	1	15.81	.....	74.01
Mean for—						
1889	172	35	7	14.34	0.86	77.39
1890	57	42	8	14.22	0.89	72.82
1891	20	29	1	17.20	0.50	77.10
Total	.....	.....	17	14.48	0.85	75.02

MEAN VALUE OF SEED SELECTIONS.

[Total number of single canes analyzed, 104.]

No. of analyses.	Sucrose.	Purity.
	Per cent.	
60	15.46	73.92
9	17.07	75.56
3	17.33	76.20
1	17.50	76.60

Selection No. 206.

[Average samples.]

	No. of variety.	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
				Per cent.	*Per cent.*	
Parent head, 1888	2040	.....	1	17.12	.....	.....
Mean for—						
1889	206	34	8	14.42	0.91	.....
1890	56	50	10	13.96	1.11	74.09
1891	33	30	1	16.40	0 50	75.20
Total	.....	.....	20	14.42	0.99	74.19

MEAN VALUE OF SEED SELECTIONS.

[Total number of single canes analyzed, 68.]

No. of analyses.	Sucrose.	Purity.
	Per cent.	
38	16.41	73.28
9	17.30	74.84
4	17.57	76.22
1	17.90	78.30

The mean of all the analyses of these ten lots of Link's Hybrid canes, grown from selected seed, for 1891 is: Sucrose, 14.60; glucose, 0.63; purity, 73.10.

The mean of all Link's Hybrid lots in 1891 is: Twenty-nine days, 276 analyses, 14.05 sucrose, 0.85 glucose, 70.25 purity, which shows a difference in favor of canes grown from selected seeds of 0.55 sucrose, 0.22 glucose, 2.85 purity. This difference is small, but such differences are cumulative and are similar to those given for the sugar beet, as shown in Prof. Maercker's results, quoted before.

LINK'S HYBRID AND AMBER CROSSES.

In 1890, 455 lots were planted in crosses of these varieties, all of them differing in type, in the hope of selecting from them one or more superior new varieties.

In 1891, 13 of these gave as a mean of 57 analyses, covering an average period of 20 days: Sucrose, 15.21; glucose, 0,48; purity, 73.97.

Three lots gave as a mean of 13 analyses during 20 days: Sucrose, 15.70; glucose, 0.36; purity, 77.66. Six hundred and ninety seed selections were made from these lots.

Mean value of—	Sucrose.	Purity.
	Per cent.	
452 selected canes	15.72	72.28
27 selected canes	16.92	75.77
3 selected canes	17.03	76.67

Some of these crosses produced unusually fine canes, maturing in good season, and it is believed two or three valuable new varieties may result from these selections.

Variety No. 350.

[Is same type as Link's Hybrid, slightly crossed with orange; seed lighter color.]

[Average samples.]

	No. of variety.	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
				Per cent.	*Per cent.*	
Parent head, 1889	14,142	.....	1	15.54	.....	.....
Mean for—						
1890	60	43	9	15.83	0.94	74.85
1891	(*)	23	9	15.90	0.83	75.48
Total	.....	.....	19	15.81	0.92	74.91
Mean of best lot	.....	.....	1	17.70	0.60	79.80

* Eleven lots, Nos. 23, 208 to 215, 446, and 555.

MEAN VALUE OF SEED SELECTIONS.

[Total number of single canes analyzed, 756.]

No. of analyses.	Sucrose.	Purity.
	Per cent.	
212	15.93	74.11
22	17.06	76.47
6	17.46	74.70
3	17.56	76.20

VARIETY NO. 373.

In 1888 an apparently blighted seed top was noticed, having very few seeds, which were planted in lot 373 in 1889. The canes in this lot were about half of them seedless, the remaining heads being heavy and of unknown type. By repeated selections an unmixed and nearly seedless variety has been produced. This variety is interesting, as it indicates that sorghum may be bred in extreme lines in different directions.

Variety No. 373.

[Average samples.]

	No. of variety.	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
Mean for—				*Per cent.*	*Per cent.*	
1889	373	23	5	13.10	2.80	.....
1890	170	20	4	12.31	0.91	70.15
1891	(*)	20	7	14.70	1.25	72.46
Total	.....	.....	22	14.81	1.53	71.90

* Seven lots, Nos. 40, 41, and 436 to 440.

MEAN VALUE OF SEED SELECTIONS.

[Total number of single canes analyzed, 69.]

No. of analyses.	Sucrose.	Purity.
	Per cent.	
30	16.57	73.99
7	17.31	74.57
2	17.70	74.90

VARIETY NO. 208.

Produces remarkably large canes, having unusually light seed top. The quality of the juice is remarkably good for such large canes. This promising variety originated in a cross of Amber and Link's Hybrid. The canes are larger and the juice is of better quality than in either of the parent varieties.

The canes still show some variations in type, though selections have been made in 1888, 1889, and 1890, but it is believed a valuable and uniform new variety can be developed from this rather violent cross. Sixteen lots were planted, one containing 1 acre.

Variety No. 208.

[Average samples.]

	No. of variety.	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
Mean for—				*Per cent.*	*Per cent.*	
1889	208	27	7	14.78	0.95	77.66
1890	59	29	11	15.46	0.89	77.70
1891	(*)	15	11	14.60	1.05	72.22
Total	.....	.....	29	15.04	0.97	74.60
Maximum for the best lot	.....	.....	.....	16.40	0.70	77.30

* Eleven lots, Nos. 230 to 237, 461, and 462.

MEAN VALUE FOR SEED SELECTIONS.

[Total number of single canes analyzed, 200.]

No. of analyses.	Sucrose.	Purity.
	Per cent.	
97	16.55	75.31
30	17.44	77.01
5	18.02	76.66
1	18.30	78.20

Selection No. 15x.

[Average samples.]

	No. of variety.	Days.	No. of analyses.	Sucrose.	Glucose.	Purity.
Mean for—				*Per cent.*	*Per cent.*	
1890	15*x*	36	4	15.27	0.64	75.79
1891	403	18	2	15.95	0.40	75.30
Total	.....	.....	6	15.48	0.56	75.63

MEAN VALUE OF SEED SELECTIONS.

[Total number of single canes analyzed, 46.]

No. of analyses.	Sucrose.	Purity.
	Per cent.	
12	15.72	71.68
4	16.02	72.12
1	16.60	73.50

Experiments in keeping cane.

[Canes were cut and left in the field, each cane being separately exposed to the weather.]

FOLGER'S EARLY.

Serial No.	Plat No.	Days.	Solids.	Sucrose.	Glucose.	Ratio.	Purity.
			Per cent.	*Per cent.*	*Per cent.*		
2432	593	0	21.00	13.80	1.90	.....	65.70
2504	593	2	22.00	11.70	3.00	.....	53.20
2635	593	8	23.10	10.00	2.00	.....	43.30
2651	593	9	24.90	7.70	.....	.....	30.90
2665	593	10	23.40	7.10	4.50	.....	30.30

COLLIER'S.

2434	594	0	20.90	16.00	1.30	.....	80.00
2501	594	2	24.10	14.80	1.30	.....	61.40
2638	594	8	23.70	12.80	3.80	.....	54.00
2648	594	9	26.40	13.80	3.80	.....	52.30
2661	594	10	26.20	15.20	4.00	.....	58.00

VARIETY NO. 91.

2430	584	0	20.20	14.10	1.50	.....	69.80
2503	584	2	24.60	12.00	2.20	.....	48.80
2637	584	8	23.00	12.10	3.00	.....	52.60
2652	584	9	23.80	10.30	3.70	.....	30.50
2663	584	10	22.80	10.30	6.00	.....	45.10

LINK'S HYBRID.

2428	31	0	21.50	15.80	0.70	.....	73.50
2502	31	2	22.20	15.50	1.30	.....	70.10
2634	31	8	22.90	14.70	1.10	.....	64.20
2647	31	9	24.10	15.00	1.90	.....	62.30
2659	31	10	24.00	15.20	2.30	.....	63.30

Experiments in keeping cane—Continued.

COLLIER'S.

[Canes were cut and piled, slightly covered by leaves.]

Serial No.	Plat No.	Days.	Solids.	Sucrose.	Glucose.	Ratio.	Purity.
			Per cent.	*Per cent.*	*Per cent.*		
2256	.....	0	20.40	15.10	0.40	2.05	74.10
2435	.....	3	22.40	16.80	0.70	4.17	75.00
2476	.....	5	23.54	17.70	0.30	1.70	75.30
2564	.....	6	24.10	17.70	0.60	3.40	73.40
2636	.....	11	23.50	16.60	0.80	4.82	70.50
2670	.....	20	26.30	19.20	1.76	.....	73.00

McLEAN'S.

2257	.....	0	21.30	16.30	0.40	.....	76.60
2436	.....	3	23.30	17.90	0.40	.....	76.90
2476	.....	5	23.34	17.30	0.60	.....	74.20
2565	.....	6	23.20	17.50	0.40	.....	75.20
2630	.....	11	23.60	17.10	0.40	.....	72.50
2672	.....	20	26.10	19.50	1.83	.....	74.80

FOLGER'S EARLY, SPECIAL NO. 2.

[Cane was cut and piled on the ground without cover.]

2293	593	0	18.60	12.30	1.70	.....	66.20
2431	593	2	19.70	13.70	1.60	.....	69.50
2470	593	4	21.80	14.50	1.50	.....	66.60
2568	593	5	22.30	12.80	2.20	.....	57.40
2629	593	10	21.90	12.40	2.60	.....	56.60
2669	593	20	25.80	10.10	9.14	.....	39.10

VARIETY NO. 91.

2295	584	0	19.30	14.10	1.10	.....	73.10
2429	584	2	20.60	15.30	1.00	.....	74.20
2477	584	4	21.62	15.50	1.30	.....	71.80
2571	584	5	22.10	14.00	2.50	.....	63.30
2631	584	10	21.80	13.60	1.50	.....	62.40
2667	584	20	24.40	11.40	6.62	.....	46.80

COLLIER'S.

2294	594	0	18.50	13.00	1.10	.....	70.30
2433	594	2	22.80	16.30	1.40	.....	71.50
2480	594	4	24.00	16.00	2.20	.....	66.70
2570	594	5	24.00	14.00	3.60	.....	58.00
2632	594	10	24.60	15.00	2.00	.....	61.00
2668	594	20	27.50	14.90	6.00	.....	54.20

LINK'S HYBRID.

2292	31	0	20.30	15.00	0.30	.....	73.90
2427	31	2	21.40	15.80	0.60	.....	73.80
2478	31	4	22.23	15.80	1.10	.....	71.20
2569	31	5	23.40	15.80	1.40	.....	67.50
2633	31	10	22.60	14.60	1.50	.....	64.60
2671	31	20	23.80	15.30	2.95	.....	64.20

Thinking it would be of some interest to determine the actual difference in perfect and fired cane, I prepared table No. 59. An examina-

tion of this table will show a most astonishing deterioration, in every respect, in the fired cane. This table will in a measure explain the great differences observed in cane supplied to mills.

Table showing the difference in "fired" and "nonfired" cane.

FIRED CANE.

Serial No.	Plat.	Solids.	Sucrose.	Glucose.	Purity.
		Per ct.	*Per cent.*	*Per cent.*	
740	563	15.40	8.30	2.20	54.00
769	544	17.40	10.70	2.70	61.50
855	544	18.70	11.40	1.50	60.90
965	545	19.00	13.20	1.70	69.50
968	546	19.60	12.80	2.10	65.30
974	558	19.90	14.50	.....	72.90
984–85	550	18.60	12.90	1.10	69.50
1067	593	15.40	8.20	3.00	53.20
1128	560	16.40	9.50	2.70	58.00
1175	593	19.40	12.50	3.20	64.30
1378*	543	19.80	14.20	0.80	71.70
1470	555	20.00	14.60	1.00	73.00
1847	543	18.80	13.40	0.80	71.30
1850–51	544	17.70	11.50	1.60	64.80
.....	.....	18.29	11.98	1.74	64.99

* Possibly an error in copying.

NOT FIRED.

739–41	563	22.60	16.70	0.85	73.80
771–72	544	21.90	15.80	1.40	71.70
854–56	544	22.30	15.70	1.70	70.00
966–67	545	19.80	13.90	1.10	70.10
969–70	546	20.10	12.90	2.00	63.80
975–76	558	20.70	15.30	1.10	73.80
983	550	19.00	13.20	1.00	69.50
1065–66	593	19.70	13.70	1.90	69.50
1127–29	560	20.90	12.90	0.70	58.90
1176	593	20.90	14.50	1.90	69.40
1376–77	543	19.20	13.10	1.10	68.50
1471–72	555	21.40	15.70	1.00	73.30
1846–48	543	19.10	13.70	0.90	71.50
1849	544	19.10	13.50	1.10	70.60
.....	.....	20.48	14.33	1.27	69.60

Table showing the relative values and position of seed, selected varieties, as based on their mean sucrose.

Scale.	Variety.	Sucrose.
		Per cent.
1	McLean's	17.85
2	Planter s Friend	17.80
3	Collier's	17.69
4	Link's Hybrid (Plat 27)	17.58
5	Link's Hybrid and Amber (Plat 29)	17.09
6	Link's Hybrid (Plat 22)	17.06
7	Colman's cane	16.96
8	Link's Hybrid (Plat 31)	16.96
9	Link's Hybrid (Plat 33)	16.71
10	Link's Hybrid (Plat 23)	16.46
11	Link's Hybrid (Plat 20)	16.36
12	Black African	16.35
13	Early Orange	16.34
14	Variety No. 160	16.34
15	Link's Hybrid and Amber	16.26
16	Variety No. 161	16.22
17	Folger's Early	16.16
18	Link's Hybrid and Amber (Plat 79)	16.09
19	Link's Hybrid (Plat 25)	15.89
20	Link's Hybrid (Plat 504)	15.80
21	White India and Orange	15.77
22	Link's Hybrid (Plat 156)	15.74
23	Variety No. 110	15.50
24	Variety No. 112	15.38
25	Early Amber	14.10

Table showing the relative values and position of seed, selected varieties, as based on their mean purity.

Scale.	Variety.	Purity.
1	McLean's	78.96
2	Colman's cane	78.16
3	Planter's Friend	77.99
4	Link's Hybrid (Plat 27)	77.44
5	Variety 161	77.27
6	Collier's	77.21
7	Link's Hybrid (Plat 25)	77.14
8	Link's Hybrid (Plat 556)	77.08
9	Early Orange	77.05
10	Variety 110	76.90
11	Link's Hybrid (Plat 31)	76.85
12	Black African	76.83
13	Link's Hybrid and Amber (Plat 29)	76.75
14	Link's Hybrid (Plat 23)	76.74
15	Folger's Early	76.61
16	Variety No. 112	76.59
17	White India and Orange	76.51
18	Early Amber	76.25
19	Link's Hybrid and Amber	76.25
20	Link's Hybrid (Plat 20)	76.22
21	Link's Hybrid (Plat 78)	76.07
22	Link's Hybrid (Plat 22)	76.05
23	Link's Hybrid (Plat 33)	76.02
24	Link's Hybrid (Plat 504)	76.00
25	Variety No. 160	75.99

Table showing dates at which the various varieties reached their maximum sucrose, selected from average analysis.

Scale.	Variety.	Date.
1	Early Amber	Sept. 20
2	Folger's Early	Sept. 20
3	Collier's	Sept. 20
4	Kansas Orange	Sept. 21
5	Undendebule (No. 2)	Sept. 21
6	Chinese Imphee	Sept. 23
7	Link's Hybrid and India	Sept. 24
8	Early Orange	Sept. 24
9	Sorghum Bicolor	Sept. 24
10	Link's Hybrid	Sept. 25
11	Variety 112	Sept. 25
12	Seedless, lot 170	Sept. 25
13	Dendemuka	Sept. 25
14	Ubehlana	Sept. 25
15	Link's Hybrid, Crosses	Sept. 26
16	Variety 110	Sept. 27
17	Link's Hybrid and Orange	Sept. 28
17*a*	Coleman's cane	Sept. 30
18	McLean's	Sept. 30
19	Variety 161	Sept. 30
20	Golden Orange	Sept. 30
21	White Mammoth and Orange	Sept. 30
22	White Mammoth and Link's Hybrid	Sept. 30
23	India and Orange	Sept. 50
24	Giant Honduras	Oct. 2
25	Honey Dew	Oct. 2
26	White Enfield	Oct. 5
27	Plat O	Oct. 14

Table showing the relative value and position of varieties as based on the analysis of an average sample with maximum purity.

Scale.	Variety.	Purity.
1	Variety 160	84.50
2	Link's Hybrid	81.70
3	Link's Hybrid and Amber	81.30
4	Undendebule (No. 2)	81.20
5	Collier's	81.00
6	McLean's	80.80
7	Colman's cane	80.50
8	Kansas Orange	80.20
9	White Mammoth and Orange	80.20
10	Planter's Friend	79.70
11	White Mammoth and Link's Hybrid	79.50
12	Black African	78.90
13	Variety 161	78.70
14	Link's Hybrid Crosses	78.70
15	Variety 112	78.70
16	Early Amber	78.00
17	India and Orange	77.80
18	Golden Orange	77.80
19	Folger's Early	77.20
20	Early Orange	76.70
21	McLean's No. 1	76.20
22	Variety 110	75.80
23	Seedless, lot 170	75.70
24	Chinese Imphee	74.30
25	Link's Hybrid and Orange	73.90
26	Honey Dew	73.80
26a	Collier's Special Ubehlana	73.80
27	Ubehlana	73.70
28	Dendemuka	73.10
29	Kansas Orange and Link's Hybrid	72.60
30	Sorghum Bicolor	72.20
31	Reversion of Amber and Link's Hybrid	69.50
32	Link's Hybrid and India	69.50
33	White Enfield	62.80
34	Giant Honduras	55.50
35	Ufatane	53.50
36	Alapore Jooar	53.00
37	Honduras	40.10

Table showing number of days required for each variety to reach 11 per cent of sucrose.

Scale.	Variety.	Days.
1	Early Amber	123
2	Folger's Early	123
3	Link's Hybrid and Amber	123
4	Colman's cane	133
5	Chinese Imphee	134
6	Variety 160	134
7	Black African	135
8	Variety 161	135
9	Collier's	137
10	Link's Hybrid	141
11	Link's Hybrid Crosses	141
12	Dendemuka	142
13	India and Orange	142
14	Golden Orange	144
15	Undendebule (No 2)	144
16	White Mammoth and Orange	146
17	Planter's Friend	148
18	Honey Dew	149
19	Variety 110	149
19a	McLean's	150
20	Sorghum Bicolor	150
21	Variety 112	150
22	Link's Hybrid and India	152
23	Ubehlana	156
24	Collier's Special Ubehlana	156
25	Seedless, lot 170	156

Table showing dates on which the variety reached 11 per cent sucrose.

Scale.	Variety.	Date.
1	Early Amber	Aug. 18
2	Link's Hybrid and Amber	Aug. 19
3	Chinese Imphee	Aug. 29
4	Folger's Early	Aug. 29
5	Colman's cane	Aug. 29
6	Black African	Aug. 29
7	Variety 161	Aug. 29
7a	McLean's	Sept. 1
8	Early Orange	Sept. 2
9	Variety 160	Sept. 3
10	Collier's	Sept. 5
11	Dendemuka	Sept. 7
12	India and Orange	Sept. 7
13	Link's Hybrid Crosses	Sept. 11
14	Link's Hybrid	Sept. 11
15	Planter's Friend	Sept. 14
16	Undendebule No. 2	Sept. 14
17	Variety 110	Sept. 14
18	Honey Dew	Sept. 14
19	Sorghum Bicolor	Sept. 14
20	Variety 112	Sept. 14
21	White Mammoth and Orange	Sept. 15
22	Golden Orange	Sept. 20
23	Collier's Special Ubehlana	Sept. 21
24	Ubehlana	Sept. 21
25	Seedless, lot 170	Sept. 21
26	White Mammoth and Link's Hybrid	Sept. 24

Table showing dates at which the various varieties reached their minimum glucose, selected from average analysis.

Scale.	Variety.	Date.
1	Link's Hybrid and Orange	Sept. 21
2	Chinese Imphee	Sept. 23
3	Link's Hybrid and India	Sept. 24
4	Early Orange	Sept. 24
5	Sorghum Bicolor	Sept. 24
6	White Mammoth and Link's Hybrid	Sept. 25
7	Honey Dew	Sept. 27
8	Variety 110	Sept. 27
9	Undendebule (No. 2)	Sept. 28
10	Golden Orange	Sept. 28
11	Early Amber	Sept. 30
12	Folger's Early	Sept. 30
13	Variety 161	Sept. 30
14	Link's Hybrid	Sept. 30
15	Variety 112	Sept. 30
16	Seedless Lot 170	Sept. 30
16a	Mc Lean's	Sept. 30
17	Dendemuka	Sept. 30
18	Link's Hybrid Crosses	Sept. 30
19	Ubehlana	Sept. 30
20	White Mammoth and Orange	Sept. 30
21	Kansas Orange and Link's Hybrid	Sept. 30
22	India and Orange	Oct. 5
23	Whiting's Early	Oct. 5
24	Kansas Orange	Oct. 5
25	Collier's	Oct. 6
26	Giant Honduras	Oct. 12
27	Plat O	Oct. 14

Table showing dates at which the various varieties reached their maximum purity.

Scale.	Variety.	Date.
1	Link's Hybrid and Orange	Sept. 21
2	Chinese Imphee	Sept. 23
3	Sorghum Bicolor	Sept. 24
4	Link's Hybrid and India	Sept. 24
5	Early Orange	Sept. 24
5a	Collier's	Sept. 25
6	Kansas Orange and Link's Hybrid	Sept. 25
7	Seedless Lot 170	Sept. 25
8	Variety 112	Sept. 25
9	Link's Hybrid	Sept. 25
10	Link's Hybrid Crosses	Sept. 26
11	Variety 110	Sept. 27
12	Early Amber	Sept. 28
13	Whiting's Enfield	Sept. 28
14	Undendebule (No. 2)	Sept. 28
14a	McLean's	Sept. 30
15	Folger's Early	Sept. 30
16	Variety 161	Sept. 30
17	Dendemuka	Sept. 30
18	Ubehlana	Sept. 30
19	Golden Orange	Sept. 30
20	White Mammoth and Orange	Sept. 30
21	White Mammoth and Link's Hybrid	Sept. 30
22	Ufatane	Oct. 2
23	Honey Dew	Oct. 2
24	Plat O	Oct. 4
25	Kansas Orange	Oct. 5
26	India and Orange	Oct. 5
27	Giant Honduras	Oct. 12

Table showing the relative value and position of varieties as based on the analysis of an average sample with maximum sucrose.

Scale.	Varieties.	Sucrose.
		Per cent.
1	McLean's	18.90
2	Collier's	18.30
3	Link's Hybrid	17.70
4	Colman's cane	17.70
5	Link's Hybrid Crosses	17.60
6	India and Orange	17.50
7	Variety 161	17.30
8	Planter's Friend	17.10
9	Early Orange	17.00
10	Variety 112	16.90
11	McLean's No. 1	16.90
12	Folger's Early	16.50
13	Seedless Lot 70	16.50
14	Link's Hybrid and Amber	16.50
15	Undendebule No. 2	16.30
16	Variety 160	16.20
17	White Mammoth and Orange	16.20
18	Chinese Imphee	15.90
19	Collier's Special Ubehlana	15.90
20	Black African	15.60
21	Kansas Orange	15.50
22	Early Amber	15.40
23	Golden Orange	15.40
24	Variety 110	15.30
25	White Mammoth and Link s Hybrid	15.20
26	Link's Hybrid and Orange	14.80
27	Ubehlana	14.60
28	Sorghum Bicolor	14.60
29	Kansas Orange and Link's Hybrid	14.30
30	Dendemuka	14.10
31	Honey Dew	13.20
32	Link's Hybrid and India	12.90
33	Reversion to Amber and Link's Hybrid	12.80
34	White Enfield	10.30
35	Giant Honduras	8.50
36	Ufatane	8.40
37	Alapore Jooar	7.80
38	Honduras	4.90

Table showing number of days required for each variety to reach a purity of 70 per cent.

Scale.	Variety.	Days.
1	Early Amber	138
2	Black African	139
3	Folger's Early	140
4	Chinese Imphee	140
5	Amber and Link's Hybrid	142
6	Planter's Friend	142
7	McLean's	145
8	Variety 112	145
9	Variety 160	145
10	Variety 161	146
11	Undendebule (No. 2)	146
12	Collier's	147
13	Seedless lot 170	147
14	India and Orange	149
15	Link's Hybrid	150
16	Colman's cane	152
17	Variety 110	153
18	Dendemuka	154
19	Sorghum Bicolor	154
20	Golden Orange	155
21	Early Orange	157
22	White Mammoth and Link's Hybrid	158
23	Collier's Special Ubehlana	159
24	White Mammoth and Orange	159
25	Ubehlana	175
26	Honey Dew	178

Table showing dates on which the variety reached a purity of 70 per cent.

Scale.	Variety.	Date.
1	Chinese Imphee	Sept. 7
2	Early Amber	Sept. 9
3	Folger's Early	Sept. 9
4	Black African	Sept. 11
5	Amber and Link's Hybrid	Sept. 12
6	Variety 160	Sept. 13
7	McLean's	Sept. 13
8	Variety 161	Sept. 14
9	Variety 112	Sept. 15
10	Planter's Friend	Sept. 15
11	Undendebule No. 2	Sept. 15
12	Collier's	Sept. 17
13	Link's Hybrid	Sept. 18
14	White Mammoth and Orange	Sept. 19
15	Colman's cane	Sept. 20
16	Variety 110	Sept. 20
17	Seedless lot 170	Sept. 20
18	Sorghum Bicolor	Sept. 21
19	Dendemuka	Sept. 21
20	Early Orange	Sept. 24
21	India and Orange	Sept. 25
22	Collier's Special Ubehlana	Sept. 25
23	Golden Orange	Sept. 25
24	Ubehlana	Sept. 30
25	White Mammoth and Link's Hybrid	Sept. 30
26	Honey Dew	Oct. 5

Table showing the relative value and position of varieties as based on the analysis of an average sample with minimum glucose.

Scale.	Variety.	Glucose.
		Per cent.
1	Variety 161	0.20
2	Link's Hybrid	0.20
3	Link's Hybrid Crosses	0.20
4	Chinese Imphee	0.30
5	Variety 112	0.30
6	McLean's	0.30
7	Variety 160	0.30
8	Colman's cane	0.30
9	Collier's	0.30
10	India and Orange	0.40
11	Kansas Orange	0.40
12	Variety 110	0.40
13	Black African	0.40
14	Planter's Friend	0.40
15	McLean's No. 1	0.40
16	Link's Hybrid and Amber	0.40
17	Sorghum Bicolor	0.40
18	Link's Hybrid and Orange	0.50
19	Early Amber	0.50
20	Undendebule No. 2	0.50
21	Early Orange	0.50
22	Golden Orange	0.60
23	White Mammoth and Orange	0.60
24	Alapore Jooar	0.70
25	Honey Dew	0.70
26	Ubehlana	0.70
27	Folger's Early	0.70
28	Dendemuka	0.80
29	Seedless Lot 170	0.90
30	White Mammoth and Link's Hybrid	1.00
31	Collier's Special Ubehlana	1.00
32	Kansas Orange and Link's Hybrid	1.20
33	Giant Honduras	1.55
34	Honduras	1.60
35	Link's Hybrid and India	1.60
36	Reversion of Link's Hybrid and Amber	2.20

Table showing the relative value and position of varieties for the past four years as based on the mean of their maximum sucroses.

Varicty.	1888.		1889.		1890.		1891.		Mean relative position.
	Relative position.	Sucrose.	Relative position.	Sucrose.	Relative position.	Sucrose.	Relative position.	Sucrose.	
		Per ct.		*Per ct.*		*Per ct.*		*Per ct.*	
McLean's (Australian)	0	0	0	0	4	15.22	1	16.40	1
Variety No. 350	0	0	1	15.54	1	15.83	2	15.90	2
Collier's (Undendebule No. 1)	3	12.31	4	14.91	1	15.95	8	14.80	3
Planter's Friend	4	12.15	7	14.43	7	14.47	3	15.80	4
Colman's Cane	0	0	6	14.58	6	14.88	4	15.60	5
Variety No. 91	0	0	2	15.47	3	15.69	14	14.10	6
Variety No. 112	0	0	9	14.23	14	13.55	6	15.00	7
Link's Hybrid	2	13.02	3	15.16	18	13.37	7	14.85	8
Variety No. 208	0	0	5	14.78	5	15.16	5	15.04	9
Folger's Early	7	10.66	20	11.92	8	14.12	10	14.60	10
Black African	0	0	9	14.24	19	13.36	9	14.80	11
Variety No. 161	0	0	13	13.24	9	14.03	11	14.60	12
Undendebule (No. 2)	0	0	0	0	9	13.64	13	14.30	13
Chinese Imphee	0	0	13	13.81	9	14.03	15	14.10	14
Variety No. 110	0	0	8	14.25	10	13.89	12	14.50	15
Early Orange	6	10.40	18	12.12	16	13.50	18	13.60	16
Variety No. 160	0	0	12	13.84	10	14.01	19	13.30	17
Golden Orange	0	0	15	12.48	15	13.56	17	13.80	18
Dendemuka	0	0	18	12.20	17	13.46	16	13.90	19
Ubehlana	1	13.10	20	12.03	22	12.51	21	13.00	20
Honey Dew	6	11.00	0	0	24	11.47	20	13.20	21
Sorghum Bicolor	5	11.61	16	12.43	21	12.80	22	13.00	22
Early Amber	9	9.50	20	11.69	20	12.84	23	12.90	23

Table showing relative value and position of varieties for the past four years as based on the mean of their minimum glucose.

Variety.	1888.		1889.		1890.		1891.		Mean relative position.
	Relative position.	Glucose.	Relative position.	Glucose.	Relative position.	Glucose.	Relative position.	Glucose.	
		Per ct.		*Per ct.*		*Per ct.*		*Per ct.*	
McLean's (Australian)	0	0	0	0	1	.52	1	.55	1
Variety 161	0	0	1	.45	4	2.67	4	.81	2
Collier's (Undendebule No. 1)	1	.73	6	.75	2	.59	8	.90	3
Colman's Cane	0	0	13	1.15	6	.84	3	.73	4
Variety No. 350	0	0	0	0	10	.94	5	.83	5
Link's Hybrid	3	10.6	6	.65	13	1.15	6	.83	6
Variety No. 110	0	0	7	.76	9	.94	2	.62	7
Variety No. 160	0	0	3	.61	3	.62	14	1.02	8
Chinese Imphee	0	0	4	.61	5	.73	15	1.10	9
Variety No. 91	0	0	3	.59	6	.84	16	1.18	10
Variety No. 112	0	0	11	1.08	13	1.73	3	.74	11
Sorghum Bicolor	0	0	9	.90	11	.96	9	.90	12
Variety No. 208	0	0	9	.95	8	.89	11	.97	13
Undendebule (No. 2)	0	0	0	0	12	1.10	10	.92	14
Planter's Friend	5	1.78	15	1.47	21	1.88	12	1.00	15
Honey Dew	0	0	0	0	14	1.30	13	1.05	16
Golden Orange	0	0	18	2.04	18	1.70	7	.88	17
Dendemuka	0	0	11	1.16	16	1.47	17	1.23	18
Early Amber	9	2.35	14	1.25	18	1.05	20	1.53	19
Folger's	6	1.88	18	1.74	21	1.75	19	1.35	20
Ubehlana	0	0	19	2.25	23	2.52	21	1.54	21
Black African	0	0	8	.81	16	1.32	18	1.25	22
Early Orange	10	2.80	20	2.52	22	2.15	22	2.24	23

Table showing the relative value of varieties for the past four years as based on the mean of their maximum purity.

Variety.	1888.		1889.		1890.		1891.		Mean relative position.
	Relative position.	Purity.	Relative position.	Purity.	Relative position.	Purity.	Relative position.	Purity.	
McLean's (Australian)	0	0	0	0	4	76.80	1	77.40	1
Colman's cane	0	0	12	75.55	5	76.38	2	76.30	2
Collier's (Undendebule No. 1)	2	71.69	7	76.95	9	74.73	9	73.80	3
Variety No. 161	0	0	6	77.33	4	75.92	5	74.80	4
Variety No. 208	0	0	4	77.76	1	77.70	6	74.40	5
Variety No. 91 (289)	0	0	2	79.74	2	76.47	14	72.35	6
Link's Hybrid	1	72.09	3	79.00	16	71.77	11	73.35	7
Variety No. 112	0	0	7	76.42	10	74.75	9	73.70	8
Variety No. 350	0	0	18	70.95	7	74.85	3	75.48	9
Planter's Friend	7	65.39	11	76.06	18	71.49	4	75.08	10
Folger's Early	5	68.24	14	73.15	6	74.91	12	73.30	11
Chinese Imphee	0	0	9	76.38	7	74.90	21	69.00	12
Black African	0	0	10	76.32	19	70.73	10	73.70	13
Variety No. 160	0	0	4	77.49	12	74.05	19	71.20	14
Golden Orange	6	66.54	17	72.60	13	72.64	16	72.00	15
Early Amber	8	63.34	13	73.94	19	71.02	15	72.20	16
Honey Dew	3	70.00	0	0	21	68.07	17	71.70	17
Dendemuka	0	0	16	72.78	11	74.44	18	71.60	18
Ubehlana	4	69.50	21	69.78	22	66.94	20	69.10	19
Early Orange	9	62.93	20	70.55	15	72.08	21	68.20	20
Sorghum Bicolor	0	0	17	71.80	21	69.41	22	67.70	21

Seed Heads Selected to be Propagated in 1892.

EARLY AMBER.

Parent plat.	Plat.	Serial No.	Date.	Sucrose.	Purity.	Parent plat.	Plat.	Serial.	Date.	Sucrose.	Purity.
				Per ct.						*Per ct.*	
(*)	36	1	Aug. 24	14.9	75.20	(*)	169	498	Sept. 1	14.1	75.30
(*)	36	51	Aug. 24	13.2	74.50	(*)	169	504	Sept. 1	14.2	75.10
(*)	36	76	Aug. 25	13.2	75.80	(*)	169	508	Sept. 1	15.0	75.80
(*)	36	87	Aug. 25	13.8	75.60	(*)	169	631	Sept. 2	14.0	75.30
(*)	169	248	Aug. 28	13.6	75.90	(*)	169	636	Sept. 2	13.9	77.20
(*)	169	256	Aug. 28	13.3	75.10	(*)	169	639	Sept. 2	15.1	77.00
(*)	169	257	Aug. 28	14.4	80.00	(*)	547	657	Sept. 3	14.1	75.40
(*)	169	258	Aug. 28	13.7	76.10	(*)	169	1588	Sept. 5	15.1	80.30
(*)	169	305	Aug. 28	13.8	75.40	52	58	1605	Sept. 5	14.7	76.50
(*)	169	317	Aug. 28	13.9	76.80	(*)	169	1760	Sept. 5	15.2	77.20
(*)	547	359	Sept. 1	14.7	79.00	(*)	169	1769	Sept. 5	14.8	77.10
(*)	547	360	Sept. 1	13.4	77.90	(*)	169	1775	Sept. 5	14.3	76.00
(*)	169	381	Sept. 1	13.8	77.10	(*)	169	1786	Sept. 5	14.9	75.90
(*)	169	390	Sept. 1	13.7	77.00	(*)	169	1800	Sept. 5	14.4	75.40
(*)	169	394	Sept. 1	13.9	75.10	(*)	169	1806	Sept. 5	15.0	78.10
(*)	169	402	Sept. 1	13.1	76.20	(*)	169	1808	Sept. 5	14.7	75.40
(*)	169	420	Sept. 1	13.5	75.90	(*)	169	1812	Sept. 5	14.5	75.10
(*)	169	422	Sept. 1	13.0	75.60	(*)	547	2706	Sept. 8	15.6	76.80
(*)	169	424	Sept. 1	13.3	76.00	(*)	547	2714	Sept. 8	15.2	75.20
(*)	169	428	Sept. 1	13.2	75.40	(*)	547	2832	Sept. 8	14.5	75.90
(*)	169	431	Sept. 1	13.3	75.20	(*)	547	2834	Sept, 8	14.6	79.80
(*)	169	434	Sept. 1	13.6	75.10	(*)	547	2870	Sept. 8	15.1	76.30
(*)	169	465	Sept. 1	13.5	75.00	(*)	547	2882	Sept. 8	15.1	75.90
(*)	169	490	Sept. 1	14.8	76.60	(*)	547	2923	Sept. 8	14.7	75.00
(*)	169	491	Sept. 1	14.0	75.30	(*)	169	3255	Sept. 8	14.0	76.50
(*)	169	492	Sept. 1	14.6	75.60						
(*)	169	493	Sept. 1	13.5	77.60	Mean of 53				14.18	76.25
(*)	169	497	Sept. 1	14.0	75.70						

EARLY ORANGE.

103	1	5415	Sept. 12	15.5	75.20	102	552	12512	Sept. 22	15.9	78.30
103	1	5417	Sept. 12	16.7	81.90	102	552	12514	Sept. 22	16.8	80.80
103	1	5422	Sept. 12	15.5	77.50	102	552	12522	Sept. 22	16.8	77.50
103	1	5424	Sept. 12	16.1	76.30	102	552	12524	Sept. 22	16.2	76.40
103	1	5427	Sept. 12	16.5	75.70	102	552	12531	Sept. 22	15.6	76.10
103	1	5433	Sept. 12	16.9	75.50	102	552	12537	Sept. 22	15.5	80.70
103	1	5435	Sept. 12	15.9	76.50	102	552	12538	Sept. 22	16.8	79.20
103	1	5436	Sept. 12	16.9	76.20	103	81	15828	Sept. 28	16.9	75.80
103	1	5438	Sept. 12	16.2	75.70	103	81	15832	Sept. 28	16.0	79.60
103	1	5439	Sept. 12	16.3	75.50	103	81	25915	Oct. 10	16.3	75.20
103	1	5440	Sept. 12	16.0	76.20	103	81	25922	Oct. 10	17.2	76.10
103	1	5443	Sept. 12	17.0	75.20	103	81	25928	Oct. 10	17.3	77.00
103	1	5444	Sept. 12	15.6	75.70	103	81	25964	Oct. 10	16.4	77.70
103	1	5446	Sept. 12	16.1	75.30	103	81	26478	Oct. 10	17.8	80.50
103	1	5447	Sept. 12	16.2	75.00	103	81	26512	Oct. 10	16.5	75.00
103	1	5448	Sept. 12	15.3	80.10	103	81	26522	Oct. 10	16.8	78.20
103	1	5449	Sept. 12	16.4	77.00						
103	1	5462	Sept. 12	15.8	78.20	Mean of 36 analyses				16.34	77.05
103	1	5470	Sept. 12	16.4	75.90	Mean of 7 analyses				17.10	76.61
103	1	5478	Sept. 12	16.3	75.20	Maximum.....				17.80	81.90

WHITE INDIA AND ORANGE.

94	53	8542	Sept. 17	15.9	75.40	(*)	584	19787	Oct. 2	15.8	76.00
94	53	8563	Sept. 17	16.0	75.10	(*)	584	19864	Oct. 2	15.6	75.70
95	51	15580	Sept. 26	17.6	75.50	(*)	584	19868	Oct. 2	15.2	78.40
(*)	584	19331	Oct. 2	16.0	76.60	(*)	564	19873	Oct. 2	16.1	78.90
(*)	584	19336	Oct. 2	16.0	76.60	(*)	584	19881	Oct. 2	15.7	79.70
(*)	584	19340	Oct. 2	16.0	76.90	(*)	584	19882	Oct. 2	15.2	76.80
(*)	584	19372	Oct. 2	15.8	76.30	(*)	584	19898	Oct. 5	17.0	77.60
(*)	584	19406	Oct. 2	15.7	75.10	(*)	584	19899	Oct. 5	15.9	76.50
(*)	584	19678	Oct. 2	15.4	76.20	(*)	584	19900	Oct. 5	15.6	78.00
(*)	584	19691	Oct. 2	15.9	75.70	(*)	584	19902	Oct. 5	16.0	76.90
(*)	584	19700	Oct. 2	15.3	75.10	91	9	26140	Oct. 10	15.9	75.70
(*)	584	19701	Oct. 2	15.5	76.70	92	43	26236	Oct. 10	15.3	77.70
(*)	584	19708	Oct. 2	15.9	76.10						
(*)	584	19753	Oct. 2	15.3	75.40	Mean of 29 analyses.....				15.77	76.51
(*)	584	19756	Oct. 2	15.3	77.70	Mean of 6 analyses				16.45	76.76
(*)	584	19778	Oct. 2	15.3	75.00	Maximum				17.60	79.70
(*)	584	19786	Oct. 2	15.3	75.70						

* Grown from average seed.

Seed Heads Selected to be Propagated in 1892.

VARIETY 112.

Parent plat.	Plat.	Serial No.	Date.	Sucrose.	Purity.	Parent plat.	Plat.	Serial No.	Date.	Sucrose.	Purity.
				Per ct.						*Per ct.*	
73	2	3148	Sept. 8	14.9	75.60	(*)	531	24426	Oct. 8	15.9	75.00
73	2	3149	Sept. 8	14.8	75.10	(*)	531	24456	Oct. 8	15.9	79.90
73	2	3151	Sept. 8	16.0	79.60	(*)	532	24913	Oct. 9	15.5	76.30
73	2	3154	Sept. 8	15.0	77.30						
73	2	3157	Sept. 8	15.0	75.40	Mean of 9 analyses.....				15.38	76.59
73	2	3160	Sept. 8	15.4	75.10						

VARIETY 110.

Parent plat.	Plat.	Serial No.	Date.	Sucrose.	Purity.
				Per ct.	
283	45	5493	Sept. 12	15.2	76.40
.....	45	5512	Sept. 12	15.8	77.40
Mean of 2 analyses.....				15.50	76.90

VARIETY 160.

Parent plat.	Plat.	Serial No.	Date.	Sucrose.	Purity.	Parent plat.	Plat.	Serial No.	Date.	Sucrose.	Purity.
				Per ct.						*Per ct.*	
328	83	10882	Sept. 19	16.0	75.50	328	12	13128	Sept. 23	16.2	76.80
328	83	10883	Sept. 19	16.0	75.50	328	12	13132	Sept. 23	16.9	75.20
328	83	10894	Sept. 19	15.4	75.80	328	12	13135	Sept. 23	17.6	76.50
328	83	10896	Sept. 19	15.7	75.80	328	12	13136	Sept. 23	17.7	78.40
328	83	11727	Sept. 21	15.6	76.10	328	12	13137	Sept. 23	16.7	76.00
328	83	11728	Sept. 21	15.8	76.00	328	192	21468	Oct. 6	16.0	75.10
328	83	11730	Sept. 21	17.3	75.60						
328	83	11731	Sept. 21	15.9	75.70	Mean of 15 analyses.....				16.34	75.99
328	83	11733	Sept. 21	16.3	75.80	Maximum				17.70	78.40

VARIETY 161.

342	11	1243	Sept. 4	15.5	75.20	36	13	13096	Sept. 23	16.7	75.30
342	11	1263	Sept. 4	14.8	80.00	36	13	13105	Sept. 23	16.5	75.70
342	11	1282	Sept. 4	15.0	78.10	36	13	13106	Sept. 23	17.5	75.50
342	11	1294	Sept. 4	15.1	76.60	36	13	13111	Sept. 23	16.5	75.70
342	11	3130	Sept. 8	15.3	76.90	(*)	542	14102	Sept. 24	17.0	76.30
342	11	3139	Sept. 8	15.0	75.80	(*)	542	14103	Sept. 24	16.9	76.90
342	11	3140	Sept. 8	15.0	75.40	(*)	542	14105	Sept. 24	16.8	76.00
342	11	4644	Sept. 11	15.3	76.90	(*)	542	14106	Sept. 24	17.5	77.90
342	11	4649	Sept. 11	15.3	75.00	(*)	542	14107	Sept. 24	16.8	77.50
342	11	4652	Sept. 11	15.3	76.50	(*)	542	14108	Sept. 24	16.8	79.20
342	11	4653	Sept. 11	15.2	76.80	(*)	542	14110	Sept. 24	16.8	76.70
342	11	4661	Sept. 11	15.2	76.00	(*)	542	14112	Sept. 24	16.4	76.70
342	11	4674	Sept. 11	15.7	76.60	(*)	542	14113	Sept. 24	16.9	77.20
342	11	4681	Sept. 11	15.5	76.00	(*)	542	14114	Sept. 24	17.3	79.00
(*)	542	5010	Sept. 12	15.3	77.70	(*)	542	14115	Sept. 24	17.7	77.00
(*)	542	5923	Sept. 14	15.3	77.30	(*)	542	14125	Sept. 24	16.8	77.50
(*)	542	5940	Sept. 14	15.4	78.60	(*)	542	14130	Sept. 24	17.0	79.10
(*)	542	7844	Sept. 16	15.6	77.20	(*)	542	14134	Sept. 24	16.2	78.30
(*)	542	7845	Sept. 16	15.7	77.30	(*)	542	14137	Sept. 24	16.4	79.20
(*)	542	8182	Sept. 17	16.3	76.20	(*)	542	14139	Sept. 24	17.5	77.90
(*)	170	9712	Sept. 18	15.7	76.20	(*)	542	14272	Sept. 25	16.3	80.30
(*)	170	9715	Sept. 18	16.2	76.10	(*)	542	16239	Sapt. 28	16.2	78.30
(*)	170	9720	Sept. 18	16.3	76.20	(*)	542	16240	Sept. 28	16.5	77.20
(*)	170	9741	Sept. 18	16.7	76.60	(*)	542	16257	Sept. 28	16.4	81.60
(*)	170	9745	Sept. 18	16.1	82.20	(*)	542	16258	Sept. 28	16.4	79.20
(*)	170	11495	Sept. 21	16.0	78.10	(*)	542	16645	Sept. 28	16.6	79.40
(*)	170	11497	Sept. 21	16.7	78.10	(*)	542	16648	Sept. 28	17.9	77.90
(*)	170	11499	Sept. 21	16.2	76.80						
(*)	170	12189	Sept. 22	16.9	76.00	Mean				16.22	77.27
(*)	170	12202	Sept. 22	16.1	76.30	Mean of 8 analyses.....				17.40	77.56
36	13	13092	Sept. 23	16.8	75.70	Maximum				17.90	82.20

* Grown from average seed.

Seed Heads Selected to be Propagated in 1892.

McLEAN'S.

Parent plat.	Plat.	Serial No.	Date.	Sucrose.	Purity.	Parent plat.	Plat.	Serial No.	Date.	Sucrose.	Purity.
				Percent.						*Percent.*	
(*)	548	7802	Sept. 16	17.3	76.60	(*)	548	9848	Sept. 18	18.1	78.10
(*)	548	7803	Sept. 16	17.9	76.50	(*)	548	9852	Sept. 18	18.0	79.00
(*)	548	7805	Sept. 16	17.5	76.50	(*)	548	9854	Sept. 18	17.7	77.70
(*)	561	7813	Sept. 16	17.0	77.00	(*)	548	9895	Sept. 18	18.2	79.10
(*)	561	7815	Sept. 16	16.9	85.40	(*)	548	9900	Sept. 18	18.2	78.50
(*)	548	8217	Sept. 17	17.1	78.10	(*)	548	9901	Sept. 18	18.6	79.10
(*)	548	8224	Sept. 17	17.2	77.50	(*)	548	9902	Sept. 18	18.4	78.00
(*)	548	8225	Sept. 17	17.3	78.00	(*)	548	9926	Sept. 18	17.9	78.20
(*)	548	8233	Sept. 17	17.2	77.50	(*)	548	9927	Sept. 18	18.2	78.20
(*)	548	8241	Sept. 17	16.8	80.40	(*)	548	9932	Sept. 18	17.6	78.30
(*)	548	8271	Sept. 17	17.0	77.60	(*)	548	9937	Sept. 18	17.7	77.70
(*)	548	8917	Sept. 17	17.8	76.70	(*)	548	9944	Sept. 18	17.9	78.30
(*)	548	8930	Sept. 17	17.5	78.90	(*)	548	9947	Sept. 18	18.5	79.00
(*)	548	8990	Sept. 18	17.4	76.90	(*)	548	9948	Sept. 18	17.7	77.70
(*)	548	9000	Sept. 18	17.0	78.70	(*)	548	9949	Sept. 18	18.6	79.80
(*)	548	9035	Sept. 18	18.2	76.80	(*)	548	9952	Sept. 18	17.8	77.80
(*)	548	9044	Sept. 18	18.1	77.10	(*)	548	9953	Sept. 18	18.3	77.90
(*)	548	9063	Sept. 18	17.2	77.10	(*)	548	9955	Sept. 18	18.7	78.90
(*)	548	9074	Sept. 18	18.1	77.10	(*)	548	9958	Sept. 18	18.2	77.80
(*)	548	9075	Sept. 18	17.7	77.00	(*)	548	9963	Sept. 18	17.9	80.00
(*)	548	9123	Sept. 18	18.1	77.10	(*)	548	9965	Sept. 18	17.6	78.60
(*)	548	9125	Sept. 18	17.4	77.40	(*)	548	9969	Sept. 18	18.0	77.60
(*)	348	9129	Sept. 18	17.8	77.00	(*)	548	9988	Sept. 18	18.6	78.10
(*)	548	9130	Sept. 18	17.3	77.00	(*)	548	9989	Sept. 18	18.0	78.00
(*)	548	9181	Sept. 18	17.5	76.80	(*)	548	9992	Sept. 18	18.4	78.00
(*)	548	9185	Sept. 18	18.3	77.60	(*)	548	9993	Sept. 18	19.1	78.90
(*)	548	9190	Sept. 18	17.7	81.50	(*)	548	10002	Sept. 18	18.7	78.20
(*)	561	9237	Sept. 18	17.2	77.50	(*)	548	10011	Sept. 18	18.4	81.40
(*)	561	9241	Sept. 18	17.6	77.90	(*)	548	10048	Sept. 18	19.4	85.40
(*)	561	9244	Sept. 18	17.5	76.80	(*)	548	10052	Sept. 18	18.7	79.60
(*)	561	9245	Sept. 18	17.2	79.30	(*)	548	10068	Sept. 18	18.2	79.50
(*)	561	9247	Sept. 18	17.6	78.60	(*)	548	10071	Sept. 18	18.5	77.10
(*)	561	9248	Sept. 18	16.9	78.30	(*)	548	10072	Sept. 18	18.3	77.60
(*)	561	9250	Sept. 18	17.5	77.20	(*)	548	10078	Sept. 18	18.2	77.50
(*)	561	9252	Sept. 18	17.6	77.60	(*)	548	10081	Sept. 18	18.5	78.10
(*)	561	9254	Sept. 18	17.0	76.70	(*)	548	10094	Sept. 18	18.2	82.30
(*)	561	9256	Sept. 18	17.3	77.00	(*)	548	10100	Sept. 18	19.0	81.50
(*)	561	9259	Sept. 18	17.0	77.30	(*)	548	10115	Sept. 18	18.1	77.80
(*)	561	9265	Sept. 18	17.5	77.50	(*)	548	10116	Sept. 18	18.5	78.70
(*)	561	9337	Sept. 18	18.0	78.00	(*)	561	10311	Sept. 19	17.7	78.40
(*)	561	9339	Sept. 18	17.2	77.10	(*)	551	10312	Sept. 19	18.1	81.50
(*)	561	9358	Sept. 18	17.3	78.70	(*)	561	10337	Sept. 19	17.6	78.60
(*)	561	9362	Sept. 18	17.3	77.00	(*)	561	10358	Sept. 19	17.9	80.00
(*)	561	9365	Sept. 18	17.7	77.70	(*)	561	10367	Sept. 19	19.0	78.50
(*)	561	9366	Sept. 18	17.1	77.50	(*)	561	10369	Sept. 19	18.3	77.70
(*)	561	9371	Sept. 18	17.8	80.50	(*)	561	10378	Sept. 19	18.5	79.40
(*)	561	9395	Sept. 18	17.3	80.90	(*)	561	10400	Sept. 19	17.8	79.20
(*)	561	9407	Sept. 18	17.7	77.70	(*)	561	10408	Sept. 19	18.0	79.00
(*)	561	9410	Sept. 18	17.4	80.30	127	44	10457	Sept. 19	18.3	78.90
(*)	561	9412	Sept. 18	17.3	78.70	127	44	10461	Sept. 19	17.8	84.80
(*)	561	9434	Sept. 18	17.8	77.80	(*)	561	11164	Sept. 21	18.0	77.90
(*)	561	9437	Sept. 18	17.4	77.70	(*)	561	15497	Sept. 26	18.1	78.10
(*)	561	9443	Sept. 18	18.2	78.80	(*)	561	15518	Sept. 26	18.4	77.70
(*)	561	9444	Sept. 18	17.2	77.10	(*)	561	15524	Sept. 26	18.3	77.60
(*)	561	9479	Sept. 18	17.2	77.50	(*)	561	15531	Sept. 26	17.8	78.80
(*)	561	9483	Sept. 18	17.2	77.10	(*)	561	15538	Sept. 26	18.4	79.00
(*)	561	9485	Sept. 18	17.5	78.20	(*)	589	17312	Sept. 29	17.9	77.90
(*)	561	9486	Sept. 18	17.6	77.90	(*)	589	17364	Sept. 29	18.0	81.00
(*)	561	9492	Sept. 18	17.8	78.80	(*)	589	17378	Sept. 29	18.4	80.40
(*)	561	9501	Sept. 18	18.0	80.40	(*)	589	17407	Sept. 29	18.5	78.70
(*)	561	9507	Sept. 18	17.5	77.50	(*)	589	17411	Sept. 29	17.8	80.50
(*)	561	9517	Sept. 16	18.0	79.00	(*)	589	17416	Sept. 29	18.0	83.30
(*)	561	9519	Sept. 18	17.7	79.10	(*)	589	17424	Sept. 29	17.7	78.10
(*)	561	9521	Sept. 18	17.9	77.50	(*)	589	17458	Sept. 29	17.7	78.80
(*)	561	9557	Sept. 18	17.4	78.40	(*)	589	17488	Sept. 29	17.9	77.90
(*)	361	9569	Sept. 18	17.7	78.10	(*)	589	17512	Sept. 29	17.9	79.20
(*)	561	9575	Sept. 18	17.8	77.80	(*)	589	17833	Sept. 30	17.8	77.80
(*)	561	9595	Sept. 18	18.4	78.00	(*)	589	17862	Sept. 30	17.7	79.10
(*)	561	9614	Sept. 18	18.7	79.90	(*)	589	18308	Sept. 30	17.7	79.40
(*)	561	9624	Sept. 18	17.8	79.20	(*)	389	18367	Sept. 30	17.8	78.10
(*)	561	9635	Sept. 18	17.5	77.90	(*)	561	18590	Oct. 2	18.2	77.80
(*)	561	9655	Sept. 18	17.5	79.60	(*)	561	18601	Oct. 2	18.2	77.50
(*)	561	9664	Sept. 18	18.1	78.80	(*)	561	18608	Oct. 2	17.7	78.40
(*)	548	9795	Sept. 18	18.2	77.80	(*)	561	18613	Oct. 2	17.8	78.80
(*)	548	9800	Sept. 18	18.5	78.10	(*)	561	18614	Oct. 2	18.4	78.30
(*)	548	9805	Sept. 18	18.0	77.60	(*)	589	18635	Oct. 2	17.6	77.90
(*)	548	9809	Sept. 18	17.5	77.50	(*)	589	18642	Oct. 2	17.5	78.90
(*)	548	9826	Sept. 18	18.1	84.20	(*)	589	18799	Oct. 2	17.5	78.90
(*)	548	9834	Sept. 18	18.3	77.70	(*)	589	18908	Oct. 2	18.5	78.10

* Grown from average seed.

Seed Heads Selected to be Propagated in 1892.

McLEAN'S—Continued.

Parent plat.	Plat.	Serial No.	Date.	Sucrose.	Purity.
				Per cent.	
(*)	589	18914	Oct. 2	17.5	77.90
(*)	589	18925	Oct. 2	17.5	84.10
(*)	589	18931	Oct. 2	17.6	77.90
(*)	589	18934	Oct. 2	17.5	80.30
(*)	589	18937	Oct. 2	17.7	78.10
(*)	589	18938	Oct. 2	17.6	79.60
(*)	589	18942	Oct. 2	17.6	78.30
(*)	589	19950	Oct. 5	17.8	83.20
(*)	589	19961	Oct. 5	17.8	82.00
(*)	589	19967	Oct. 5	17.5	81.80
(*)	589	19969	Oct. 5	17.7	81.50
(*)	589	20009	Oct, 5	17.5	78.90
(*)	589	20134	Oct. 5	17.6	83.90
(*)	589	20140	Oct. 5	17.7	83.90
(*)	589	20169	Oct. 5	17.7	83.90
(*)	589	20174	Oct. 5	17.7	84.40
127	171	20631	Oct. 5	17.9	80.60
127	171	20695	Oct. 5	18.4	88.40
127	171	20705	Oct. 5	18.1	79.80
127	171	20735	Oct. 5	18.5	79.00
127	171	20740	Oct. 5	17.8	79.50
127	171	20804	Oct. 5	17.8	78.50
127	172	20830	Oct. 5	17.5	78.90
127	172	20832	Oct. 5	17.5	78.20
127	172	20846	Oct. 5	17.6	78.60
127	172	20847	Oct. 5	17.8	78.80
127	172	20851	Oct. 5	17.5	81.80
127	172	20866	Oct. 5	17.9	79.20
127	172	20882	Oct. 5	17.7	79.40
127	172	20918	Oct. 5	18.0	79.00
127	172	20943	Oct. 5	18.0	79.60
127	173	20990	Oct. 5	17.6	78.90
127	173	21085	Oct. 5	17.7	79.40
127	174	21227	Oct. 5	17.8	78.50
127	174	21337	Oct. 6	19.0	87.90
127	174	21353	Oct. 6	18.3	85.60
127	174	21384	Oct. 6	17.7	79.10
127	174	21422	Oct. 6	18.3	80.00
127	445	23143	Oct. 7	17.8	78.80
127	445	23175	Oct. 7	17.6	80.00
127	445	23179	Oct. 7	18.4	79.70
127	445	23206	Oct. 7	18.0	80.40
127	445	23207	Oct. 7	18.0	80.00
Mean				17.85	78.96
Mean of 77 seed heads				18.32	79.25
Mean of 5 seed heads				19.10	82.44
Maximum				19.40	85.40
Mean of general selection, including 1620 seed heads				16.20	75.86

LINK'S HYBRID.

66	556	6107	Sept. 14	15.7	78.10
66	556	6136	Sept. 14	15.2	77.20
66	556	6352	Sept. 15	15.2	76.00
66	556	6403	Sept. 15	15.3	78.90
66	556	6427	Sept. 15	15.0	78.50
66	556	6436	Sept. 15	15.2	75.60
66	556	6600	Sept. 15	15.0	75.00
66	556	6644	Sept. 15	15.3	76.90
66	556	6647	Sept. 15	15.2	77.60
66	21	7413	Sept. 16	15.3	75.30
66	21	7414	Sept. 16	15.3	75.00
66	21	74'6	Sept. 16	15.5	76.00
66	21	7432	Sept. 16	15.7	80.10
66	21	7437	Sept. 16	15.3	75.70
66	21	7444	Sept. 16	16.0	75.50
66	556	7481	Sept. 16	15.7	75.50
66	556	7486	Sept. 16	16.9	77.10
66	556	7490	Sept. 16	15.6	77.20
66	556	7501	Sept. 16	15.6	76.10
66	556	7537	Sept. 16	15.8	76.70
66	556	7562	Sept. 16	15.5	76.00
66	556	7577	Sept. 16	15.6	76.80
66	21	10719	Sept. 19	16.0	76.90
66	21	10723	Sept. 19	16.3	75.80
66	543	13661	Sept. 24	17.5	76.80
	543	13740	Sept. 24	17.4	84.90
	543	13928	Sept. 24	17.0	79.80
Mean of 27 seed heads				15.74	77.08
Mean of 11 seed heads				16.72	77.97
Maximum				17.50	84.90
(*)	25	17085	Sept. 29	15.9	75.00
(*)	25	17090	Sept. 29	15.6	75.00
(*)	25	17097	Sept. 29	16.5	75.70
(*)	25	17119	Sept. 29	15.7	76.60
35	519	24290	Oct. 8	16.4	75.90
57	537	24736	Oct. 9	16.1	78.60
Mean of 6 seed heads				16.03	76.13
57	20	11016	Sept. 21	15.2	75.20
57	20	11025	Sept. 21	15.4	77.40
57	20	11037	Sept. 21	15.7	76.20
57	20	11042	Sept. 21	15.5	76.00
57	20	11045	Sept. 21	15.3	75.70
57	20	11047	Sept. 21	15.4	78.60
57	20	12922	Sept. 23	17.2	75.40
57	20	12934	Sept. 23	16.8	75.00
57	20	12936	Sept. 23	17.0	75.20
57	20	12938	Sept. 23	16.7	76.30
57	20	12939	Sept. 23	17.0	77.30
57	20	12940	Sept. 23	17.3	76.60
57	20	12960	Sept. 23	17.1	75.70
57	20	12961	Sept. 23	17.5	76.50
Mean of 14 seed heads				16.36	76.22
Mean of 6 seed heads				17.10	76.11
Maximum				17.50	78.60
60	23	7286	Sept. 16	16.8	75.70
60	23	7288	Sept. 16	15.8	79.40
60	23	7375	Sept. 16	16.6	75.10
60	555	17885	Sept. 30	16.3	75.20
60	555	17904	Sept. 30	16.4	75.60
60	555	17907	Sept. 30	16.2	75.70
60	555	17913	Sept. 30	16.4	76.70
60	555	17915	Sept. 30	16.4	76.10
60	555	17918	Sept. 30	16.1	76.70
60	555	17931	Sept. 30	17.4	78.00
60	555	17935	Sept. 30	16.6	76.10
60	555	17938	Sept. 30	16.8	76.40
60	555	17939	Sept. 30	16.1	76.00
60	555	17973	Sept. 30	16.0	76.20
60	555	17974	Sept. 30	16.0	75.80
60	555	17975	Sept. 30	15.8	75.20
60	590	18148	Sept. 30	16.7	77.00
60	590	18166	Sept. 30	16.0	75.50
60	590	18169	Sept. 30	16.7	76.00
60	590	18172	Sept. 30	16.4	76.70
60	590	18177	Sept. 30	16.7	75.30
60	590	18187	Sept. 30	17.5	77.30
60	590	18190	Sept. 30	16.6	75.50
60	590	18199	Sept. 30	16.7	82.70
60	590	18253	Sept. 30	16.9	76.20
60	555	22839	Oct. 7	16.1	80.50
60	555	22903	Oct. 7	16.8	77.10
60	555	22926	Oct. 7	15.5	75.60
60	555	22 33	Oct. 7	17.0	80.20
60	590	19157	Oct. 2	15.0	76.50
60	590	19172	Oct. 2	15.5	76.00
60	590	19173	Oct. 2	15.4	82.50
60	446	23212	Oct. 7	16.8	79.60
Mean of 33 seed heads				16.36	73.94

* Grown from average seed.

Seed Heads Selected to be Propagated in 1892.

LINK'S HYBRID.

Parent plat.	Plat.	Serial No.	Date.	Sucrose.	Purity.	Parent plat.	Plat.	Serial No.	Date.	Sucrose.	Purity.
				Per cent.						*Per cent.*	
30	31	15117	Sept. 26	16.9	76.20	56	33	15203	Sept. 26	17.9	78.30
30	31	15123	Sept. 26	17.1	76.40	56	33	15211	Sept. 26	16.7	75.60
30	31	15131	Sept. 26	17.2	77.90	56	33	15214	Sept. 26	16.6	75.10
30	31	15326	Sept. 26	17.6	77.60	56	33	15215	Sept. 26	17.6	75.10
30	31	15143	Sept. 26	16.3	76.20	56	33	15218	Sept. 26	16.6	75.10
30	31	15154	Sept. 26	16.4	75.90						
30	31	15155	Sept. 26	16.7	77.30	Mean of 11 seed heads.....				16.71	76.02
30	31	15166	Sept. 26	17.5	77.30	Mean of 4 seed heads.....				17.47	76.40
						Maximum				17.90	78.30
Mean of 8 seed heads.....				16.96	76.85						
Maximum				17.60	77.90	43	32	10571	Sept. 19	17.2	76.10
						43	32	10575	Sept. 19	16.8	75.30
34	27	16863	Sept. 29	17.5	75.90	43	32	10578	Sept. 19	17.0	76.70
34	27	16864	Sept. 29	16.7	76.30	43	32	10583	Sept. 19	16.7	78.60
34	27	16869	Sept. 29	16.6	75.50	43	32	10604	Sept. 19	17.5	77.20
34	27	16881	Sept. 29	17.7	75.30	43	32	10607	Sept. 19	17.2	75.10
34	27	16886	Sept. 29	18.7	77.60	43	32	10608	Sept. 19	16.1	75.60
34	27	16887	Sept. 29	17.9	87.50	43	32	10619	Sept. 19	16.0	75.80
34	27	16889	Sept. 29	18.1	75.70	43	32	10625	Sept. 19	17.0	75.60
34	27	16890	Sept. 29	18.2	76.10	43	32	10627	Sept. 19	16.6	75.80
34	27	16913	Sept. 29	16.8	77.10	43	32	10630	Sept. 19	16.8	75.00
						43	32	10631	Sept. 19	16.7	76.60
Mean of 9 seed heads.....				17.58	77.44	43	32	10632	Sept. 19	17.1	76.10
Maximum				18.70	87.50	43	32	14864	Sept. 25	17.4	75.60
						43	32	14864	Sept. 25	16.6	76.80
61	504	23850	Oct. 8	15.9	75.40	43	32	14865	Sept. 25	16.8	77.19
61	504	23911	Oct. 8	15.7	76.60	43	32	14874	Sept. 25	16.9	75.20
						43	32	14879	Sept. 25	18.2	76.10
Mean.....				15.80	76.00	43	32	14887	Sept. 25	17.8	75.70
						43	32	14889	Sept. 25	16.5	75.70
56	33	11049	Sept. 21	15.3	75.00	43	32	14900	Sept. 25	17.6	76.20
56	33	11060	Sept. 21	16.4	77.00	43	32	14928	Sept. 25	16.8	75.30
56	33	11061	Sept. 21	16.3	76.20						
56	33	11064	Sept. 21	16.0	76.60	Mean of 22 seed heads.....				17.06	76.05
56	33	15170	Sept. 26	17.1	75.40	Mean of 10 seed heads.....				17.40	76.04
56	33	15182	Sept. 26	17.3	76.80	Maximum				18.20	78.60

FOLGER'S EARLY.

110	4	721	Sept. 3	15.1	75.20	110	4	912	Sept. 3	16.6	75.10
110	4	740	Sept. 3	15.4	76.20	110	4	913	Sept. 3	15.9	75.40
110	4	747	Sept. 3	15.4	76.20	110	4	914	Sept. 3	15.2	75.00
110	4	764	Sept. 3	15.2	76.00	110	4	915	Sept. 3	16.6	78.00
110	4	780	Sept. 3	15.9	76.40	110	4	916	Sept. 3	15.6	75.50
110	4	783	Sept. 3	15.4	76.60	110	4	917	Sept. 3	16.1	77.40
110	4	784	Sept. 3	15.7	75.10	110	4	918	Sept. 3	16.4	77.30
110	4	785	Sept. 3	16.2	77.80	110	4	919	Sept. 3	15.3	75.00
110	4	786	Sept. 3	15.4	75.50	110	4	920	Sept. 3	16.2	76.40
110	4	793	Sept. 3	15.1	76.40	110	4	922	Sept. 3	16.8	76.00
110	4	796	Sept. 3	15.9	77.90	110	4	923	Sept. 3	16.6	75.50
110	4	807	Sept. 3	16.0	78.40	110	4	927	Sept. 3	16.3	77.30
110	4	812	Sept. 3	16.3	76.10	110	4	1009	Sept. 3	16.2	75.00
110	4	816	Sept. 3	16.0	75.50	110	4	1021	Sept. 3	16.8	75.70
110	4	839	Sept. 3	16.0	75.10	110	4	1022	Sept. 3	16.9	74.80
110	4	840	Sept. 3	16.4	75.50	110	4	1023	Sept. 3	16.6	74.40
110	4	842	Sept. 3	16.2	75.00	(*)	586	1355	Sept. 4	15.1	79.00
110	4	844	Sept. 3	15.8	76.40	(*)	586	1504	Sept. 4	15.2	77.90
110	4	845	Sept. 3	16.0	75.50	(*)	586	1555	Sept. 5	15.7	74.50
110	4	849	Sept. 3	16.1	75.60	(*)	586	1569	Sept. 5	15.2	74.90
110	4	850	Sept. 3	15.5	75.10	110	4	1611	Sept. 5	16.2	76.40
110	4	853	Sept. 3	15.2	75.30	110	4	1612	Sept. 5	16.6	76.50
110	4	859	Sept. 3	17.1	76.30	110	4	1613	Sept. 5	16.0	75.80
110	4	870	Sept. 3	16.3	77.60	110	4	1614	Sept. 5	15.4	76.60
110	4	871	Sept. 3	16.0	75.10	110	4	1615	Sept. 5	15.9	77.20
110	4	875	Sept. 3	15.5	76.70	110	4	1617	Sept. 5	15.8	76.70
110	4	879	Sept. 3	16.6	77.60	110	4	1619	Sept. 5	15.7	75.80
110	4	888	Sept. 3	16.3	76.20	110	4	1620	Sept. 5	16.2	76.40
110	4	891	Sept. 3	15.8	76.30	110	4	1622	Sept. 5	15.7	75.50
110	4	892	Sept. 3	15.7	75.40	110	4	1623	Sept. 5	15.7	75.10
110	4	893	Sept. 3	15.7	75.70	110	4	1626	Sept. 5	15.7	75.80
110	4	896	Sept. 3	15.0	75.00	110	4	1628	Sept. 5	16.3	75.50
110	4	897	Sept. 3	15.6	75.70	110	4	1629	Sept. 5	15.8	75.60
110	4	906	Sept. 3	16.8	80.80	110	4	1630	Sept. 5	16.4	76.70
110	4	908	Sept. 3	15.7	75.70	110	4	1644	Sept. 5	16.1	76.00
110	4	910	Sept. 3	15.9	75.40	110	4	1656	Sept. 5	16.4	75.90

* Grown from average seed.

Seed Heads Selected to be Propagated in 1892.

FOLGER'S EARLY—Continued.

Parent plat.	Plat.	Serial No.	Date.	Sucrose.	Purity.	Parent plat.	Plat.	Serial No.	Date.	Sucrose.	Purity.
				Per cent.						*Per cent.*	
110	4	1657	Sept. 5	15.9	77.20	110	4	1968	Sept. 5	17.4	75.00
110	4	1660	Sept. 5	15.3	75.00	110	4	1971	Sept. 5	17.5	80.20
110	4	1661	Sept. 5	15.6	77.20	110	4	1977	Sept. 5	17.5	77.50
110	4	1662	Sept. 5	15.4	77.40	110	4	1979	Sept. 5	16.6	76.80
110	4	1663	Sept. 5	16.1	75.30	110	4	1980	Sept. 5	16.8	76.40
110	4	1664	Sept. 5	15.7	76.60	110	4	1982	Sept. 5	17.5	76.50
110	4	1665	Sept. 5	15.9	75.40	110	4	1983	Sept. 5	17.8	78.50
110	4	1666	Sept. 5	16.0	75.50	110	4	1984	Sept. 5	16.7	76.00
110	4	1667	Sept. 5	17.0	79.50	110	4	1986	Sept. 5	15.4	77.80
110	4	1680	Sept. 5	15.8	78.20	110	4	1987	Sept. 5	17.3	78.40
110	4	1684	Sept. 5	15.8	76.00	110	4	1990	Sept. 5	17.1	80.00
110	4	1686	Sept. 5	15.6	76.80	110	4	1994	Sept. 5	16.7	76.60
110	4	1689	Sept. 5	15.2	76.00	110	4	1998	Sept. 5	17.5	77.90
110	4	1690	Sept. 5	15.8	75.20	110	4	1999	Sept. 5	17.6	76.50
110	4	1691	Sept. 5	16.6	75.80	110	4	2000	Sept. 5	17.4	79.10
(*)	540	1818	Sept. 5	15.5	80.50	110	4	2001	Sept. 5	16.0	75.10
(*)	540	1819	Sept. 5	15.5	79.50	110	4	2003	Sept. 5	16.9	75.20
(*)	540	1829	Sept. 5	15.1	81.20	110	4	2004	Sept. 5	17.2	79.60
(*)	540	1830	Sept. 5	15.6	75.70	110	4	2516	Sept. 5	16.1	77.80
(*)	540	1857	Sept. 5	15.6	77.20	(*)	540	2622	Sept. 5	15.0	75.00
(*)	540	1858	Sept. 5	15.9	77.60	(*)	540	2630	Sept. 5	15.0	75.80
(*)	540	1865	Sept. 5	15.8	81.90	(*)	540	2659	Sept. 5	15.3	75.70
(*)	540	1866	Sept. 5	15.6	76.10	(*)	540	4076	Sept. 5	15.1	77.10
(*)	540	1869	Sept. 5	15.1	76.30	(*)	540	4523	Sept. 5	15.2	75.60
(*)	540	1871	Sept. 5	15.7	78.10	(*)	540	4557	Sept. 5	15.0	75.40
(*)	540	1882	Sept. 5	15.1	75.50	(*)	540	4561	Sept. 5	15.7	78.90
110	4	1886	Sept. 5	17.5	76.40	(*)	540	4584	Sept. 5	15.3	75.00
110	4	1888	Sept. 5	17.3	74.90	(*)	540	4585	Sept. 5	15.3	75.00
110	4	1891	Sept. 5	17.3	75.20	(*)	540	4592	Sept. 5	15.2	75.20
110	4	1894	Sept. 5	17.3	76.10	(*)	540	4595	Sept. 5	15.3	76.50
110	4	1899	Sept. 5	16.5	75.00	(*)	586	4596	Sept. 11	15.0	75.40
110	4	1900	Sept. 5	16.9	76.20	(*)	586	4602	Sept. 11	15.2	75.20
110	4	1901	Sept. 5	16.8	75.70	(*)	586	4615	Sept. 11	15.1	75.10
110	4	1902	Sept. 5	16.9	76.90	(*)	586	4840	Sept. 11	15.1	75.90
110	4	1903	Sept. 5	16.9	77.60	(*)	586	4865	Sept. 11	15.4	77.00
110	4	1904	Sept. 5	17.3	77.00	(*)	586	4866	Sept. 11	15.0	77.70
110	4	1905	Sept. 5	16.8	75.70	(*)	586	4868	Sept. 11	15.0	76.90
110	4	1910	Sept. 5	17.0	77.70	(*)	586	4873	Sept. 12	15.1	76.70
110	4	1911	Sept. 5	17.0	75.20	(*)	586	4896	Sept. 12	15.0	75.80
110	4	1913	Sept. 5	18.0	79.60	(*)	586	4900	Sept. 12	15.0	77.30
110	4	1916	Sept. 5	17.6	75.90	(*)	586	4916	Sept. 12	15.0	75.40
110	4	1917	Sept. 5	18.1	79.50	(*)	586	4930	Sept. 12	15.7	78.50
110	4	1918	Sept. 5	16.6	75.50	(*)	586	4933	Sept. 12	15.3	76.50
110	4	1920	Sept. 5	16.8	76.40	(*)	586	4939	Sept. 12	15.1	76.70
110	4	1921	Sept. 5	18.0	78.70	(*)	586	4945	Sept. 12	15.0	75.40
110	4	1922	Sept. 5	17.3	77.00	(*)	586	4953	Sept. 12	15.3	77.70
110	4	1923	Sept. 5	17.4	77.40	(*)	586	4970	Sept. 12	15.3	75.70
110	4	1924	Sept. 5	16.6	75.10	(*)	586	4981	Sept. 12	15.2	76.40
110	4	1925	Sept. 5	16.5	76.40	(*)	586	4982	Sept. 12	15.3	76.10
110	4	1926	Sept. 5	18.0	79.30	(*)	586	4986	Sept. 12	15.8	79.80
110	4	1928	Sept. 5	17.8	75.70	(*)	586	4994	Sept. 12	15.1	75.90
110	4	1930	Sept. 5	16.8	76.40	(*)	586	4995	Sept. 12	15.7	78.10
110	4	1931	Sept. 5	17.3	78.70	(*)	586	4997	Sept. 12	15.2	76.80
110	4	1932	Sept. 5	17.3	75.60	(*)	586	5540	Sept. 12	15.0	75.00
110	4	1933	Sept. 5	17.5	77.90	(*)	586	8574	Sept. 17	15.5	76.70
110	4	1934	Sept. 5	18.0	80.00	(*)	586	8577	Sept. 17	15.7	77.70
110	4	1935	Sept. 5	16.7	77.70	(*)	586	8585	Sept. 17	15.9	77.20
110	4	1936	Sept. 5	17.6	79.30	(*)	586	8590	Sept. 17	16.0	75.50
110	4	1937	Sept. 5	16.7	79.90	(*)	586	8595	Sept. 17	15.3	76.50
110	4	1938	Sept. 5	16.9	76.20	(*)	586	8596	Sept. 17	15.5	72.20
110	4	1939	Sept. 5	17.8	80.90	(*)	586	8604	Sept. 17	15.4	75.50
110	4	1941	Sept. 5	17.2	78.90	(*)	586	8609	Sept. 17	15.6	75.00
110	4	1942	Sept. 5	18.3	80.70	(*)	586	8610	Sept. 17	15.7	77.00
110	4	1943	Sept. 5	16.5	77.20	(*)	586	8620	Sept. 17	15.7	75.80
110	4	1944	Sept. 5	17.0	77.30	(*)	586	8631	Sept. 17	15.3	75.40
110	4	1946	Sept. 5	16.6	76.10	(*)	586	8632	Sept. 17	15.7	76.60
110	4	1947	Sept. 5	16.6	77.90	(*)	586	8635	Sept. 17	15.1	76.70
110	4	1949	Sept. 5	17.8	89.00	(*)	586	8641	Sept. 17	16.3	77.20
110	4	1950	Sept. 5	18.0	78.30	(*)	586	8668	Sept. 17	16.1	76.00
110	4	1954	Sept. 5	17.1	79.10	(*)	540	9225	Sept. 18	15.6	75.60
110	4	1955	Sept. 5	17.8	75.70	(*)	540	9227	Sept. 18	15.0	75.40
110	4	1957	Sept. 5	16.3	76.60	(*)	593	14189	Sept. 25	16.4	81.20
110	4	1958	Sept. 5	16.9	76.90	(*)	593	14191	Sept. 25	16.0	76.90
110	4	1959	Sept. 5	17.6	78.30	(*)	593	14192	Sept. 25	15.8	75.60
110	4	1960	Sept. 5	17.6	76.50	(*)	593	14193	Sept. 25	15.7	77.00
110	4	1961	Sept. 5	17.2	76.50	(*)	593	14201	Sept. 25	15.5	76.30
110	4	1966	Sept. 5	17.9	77.50	(*)	593	14213	Sept. 25	15.5	76.70
110	4	1967	Sept. 5	17.4	75.30	(*)	593	14244	Sept. 25	16.2	75.30

* Grown from average seed.

Seed Heads Selected to be Propagated in 1892.

FOLGER'S EARLY—Continued.

Parent plat.	Plat.	Serial No.	Date.	Sucrose.	Purity.	Parent plat.	Plat.	Serial No.	Date.	Sucrose.	Purity.
				Per cent.						*Per cent.*	
(*)	593	14518	Sept. 25	15.0	75.80	(*)	540	16413	Sept. 28	17.1	75.70
(*)	593	14575	Sept. 25	15.5	75.20	(*)	540	16416	Sept. 28	16.3	76.90
(*)	593	14650	Sept. 25	15.3	75.00	(*)	540	16426	Sept. 28	15.9	75.00
(*)	593	14661	Sept. 25	16.4	75.20	(*)	540	16436	Sept. 28	16.4	75.90
(*)	540	16301	Sept. 28	16.0	75.10	(*)	540	16437	Sept. 28	15.9	76.80
(*)	540	16302	Sept. 28	15.4	77.80	(*)	540	16449	Sept. 28	16.3	75.80
(*)	540	16313	Sept. 28	16.0	75.10	(*)	540	16453	Sept. 28	15.8	76.30
(*)	540	16332	Sept. 28	16.1	75.30	(*)	540	16457	Sept. 28	16.2	76.10
(*)	540	16357	Sept. 28	17.0	75.60	(*)	540	16468	Sept. 28	16.6	75.50
(*)	540	16358	Sept. 28	17.0	78.50	(*)	540	16493	Sept. 28	16.0	76.20
(*)	540	16401	Sept. 28	16.4	75.20						
(*)	540	16404	Sept. 28	15.9	75.70	Mean				16.16	76.61
(*)	540	16405	Sept. 28	16.5	77.50	Mean of 8 seed heads				18.10	79.50
(*)	540	16408	Sept. 28	15.3	76.10	Mean of 52 seed heads				17.50	78.04
(*)	540	16410	Sept. 28	16.8	75.70	Maximum				18.30	89.00
(*)	540	16412	Sept. 28	16.6	75.80						

COLMAN'S CANE.

130	8	5761	Sept. 14	16.1	78.10	129	75	12451	Sept. 22	17.3	79.60
130	8	5771	Sept. 14	16.7	76.30	129	75	12453	Sept. 22	17.2	75.40
130	8	5783	Sept. 14	16.0	78.80	129	75	12461	Sept. 22	17.7	77.00
130	8	5794	Sept. 14	16.7	76.60	129	75	12464	Sept. 22	17.9	80.30
130	8	5796	Sept. 14	16.5	80.90	129	75	12465	Sept. 22	17.2	78.90
130	8	5806	Sept. 14	16.4	75.60	129	75	12470	Sept. 22	17.1	78.90
130	8	5849	Sept. 14	16.0	77.60	129	75	12473	Sept. 22	17.9	78.30
130	8	5852	Sept. 14	16.3	78.00	129	75	12474	Sept. 22	18.3	80.70
(*)	558	8360	Sept. 17	15.4	78.60	129	75	12475	Sept. 22	19.4	81.10
(*)	558	8363	Sept. 17	16.6	77.90	129	75	12477	Sept. 22	17.3	77.10
(*)	562	12274	Sept. 22	17.3	78.40	129	75	12479	Sept. 22	17.0	78.00
(*)	562	12275	Sept. 22	17.7	79.80	129	75	12480	Sept. 22	17.1	77.80
(*)	562	12279	Sept. 22	17.0	78.00	126	75	12481	Sept. 22	17.6	78.30
(*)	562	12282	Sept. 22	17.8	77.80	129	75	12483	Sept. 22	18.2	79.10
(*)	562	12295	Sept. 22	17.4	77.70	129	75	12488	Sept. 22	17.8	79.50
(*)	562	12299	Sept. 22	17.3	77.00	129	75	12489	Sept. 22	17.3	77.60
(*)	562	12302	Sept. 22	17.5	78.50	129	75	12490	Sept. 22	17.9	77.20
(*)	562	12303	Sept. 22	17.3	79.30	129	75	12491	Sept. 22	17.5	78.90
(*)	562	12305	Sept. 22	17.8	79.50	120	75	12492	Sept. 22	17.5	76.80
(*)	562	12306	Sept. 22	17.8	77.40	129	75	12495	Sept. 22	18.0	79.00
(*)	562	12307	Sept. 22	17.2	77.10	129	75	12498	Sept. 22	17.2	78.50
(*)	562	12311	Sept. 22	17.2	76.80	129	75	12499	Sept. 22	18.5	77.90
(*)	562	12312	Sept. 22	17.0	77.00	129	75	12505	Sept. 22	17.2	78.20
(*)	562	12313	Sept. 22	18.0	78.30	129	75	12506	Sept. 22	17.5	78.90
(*)	562	12319	Sept. 22	17.2	76.80	129	75	12508	Sept. 22	17.2	78.90
(*)	562	12338	Sept. 22	17.6	78.30	129	75	12510	Sept. 22	17.6	80.00
(*)	562	12347	Sept. 22	18.3	87.10	129	75	12511	Sept. 22	17.8	80.50
(*)	562	12356	Sept. 22	17.4	77.40	204	76	16053	Sept. 28	16.8	77.80
(*)	562	12352	Sept. 22	17.3	77.60	204	76	16062	Sept. 28	15.7	77.00
(*)	562	12355	Sept. 22	17.4	76.30	204	76	16076	Sept. 28	16.7	77.30
(*)	562	12370	Sept. 22	17.2	76.80	204	76	16087	Sept. 28	16.1	77.10
204	76	12378	Sept. 22	16.8	76.70	204	76	16089	Sept. 28	16.2	77.50
204	76	12384	Sept. 22	16.9	78.30	204	76	16101	Sept. 28	17.2	76.50
204	76	12388	Sept. 22	17.5	81.40	204	76	16102	Sept. 28	16.9	78.30
204	76	12390	Sept. 22	16.7	78.10	204	76	16103	Sept. 28	16.5	77.20
204	76	12392	Sept. 22	17.4	79.10	265	77	16127	Sept. 28	17.1	77.10
204	76	12394	Sept. 22	17.3	77.60	265	77	16131	Sept. 28	17.1	78.50
204	76	12395	Sept. 22	18.4	78.60	265	77	16143	Sept. 29	16.9	77.20
204	76	12398	Sept. 22	17.2	78.90	265	77	16145	Sept. 28	17.1	78.50
204	76	12403	Sept. 22	16.5	75.00	265	77	16159	Sept. 28	16.6	76.50
204	76	12404	Sept. 22	16.7	77.30	265	77	16161	Sept. 28	16.5	77.20
204	76	12408	Sept. 22	17.2	78.20	265	77	16164	Sept. 28	16.5	76.80
204	76	12412	Sept. 22	17.5	79.30	265	77	16165	Sept. 28	16.6	76.80
204	76	12418	Sept. 22	17.4	78.40	265	77	16172	Sept. 28	17.2	84.40
204	76	12419	Sept. 22	18.3	81.00	265	77	16186	Sept. 28	16.5	77.20
129	75	12424	Sept. 22	18.1	78.40	265	77	16188	Sept. 28	16.8	79.20
129	75	12425	Sept. 22	18.0	77.30	265	77	16190	Sept. 28	17.4	80.20
129	75	12427	Sept. 22	17.7	78.80	265	77	16192	Sept. 28	16.6	76.50
129	75	12431	Sept. 22	16.8	77.10	265	77	16202	Sept. 28	16.9	78.30
129	75	12432	Sept. 22	17.0	77.60	265	77	16204	Sept. 28	16.9	77.20
129	75	12434	Sept. 22	17.5	76.50	265	77	16211	Sept. 28	17.4	79.80
129	75	12436	Sept. 22	17.2	76.80	265	77	16215	Sept. 28	17.0	77.60
129	75	12440	Sept. 22	18.2	79.10	265	77	16225	Sept. 28	17.3	80.00
129	75	12442	Sept. 22	17.6	76.90	265	77	16226	Sept. 28	17.0	79.50
129	75	12449	Sept. 22	17.3	78.70	129	75	16652	Sept. 29	18.1	76.40

* Grown from average seed.

Seed Heads Selected to be Propagated in 1892.

COLMAN'S CANE—Continued.

Parent plat.	Plat.	Serial No.	Date.	Sucrose.	Purity.	Parent plat.	Plat.	Serial No.	Date.	Sucrose.	Purity.
				Per cent						*Per cent.*	
129	75	16660	Sept. 29	17.9	77.90	204	76	21586	Oct. 6	16.7	77.30
129	75	16678	Sept. 29	17.0	76.70	204	76	21597	Oct. 6	18.1	80.90
129	75	16670	Sept. 29	17.3	78.00	204	76	21602	Oct. 6	18.9	79.50
129	75	16675	Sept. 29	17.4	76.90	130	227	21954	Oct. 6	16.5	78.20
129	75	16676	Sept. 29	17.5	79.60	130	227	21964	Oct. 6	16.6	76.50
129	75	16677	Sept. 29	17.6	80.80	130	227	21981	Oct. 6	16.0	80.00
129	75	16678	Sept. 29	17.7	77.40	130	229	21998	Oct. 6	16.9	78.30
129	75	16679	Sept. 29	17.8	80.90	130	219	22085	Oct. 6	16.7	78.10
129	75	16682	Sept. 29	18.2	79.10	130	219	22086	Oct. 6	16.7	78.10
129	75	16691	Sept. 29	17.7	78.10	130	219	22091	Oct. 6	16.8	78.60
129	75	16700	Sept. 29	17.0	76.60	128	220	22154	Oct. 6	15.1	75.50
129	75	16706	Sept. 29	17.8	76.40	128	220	22167	Oct. 6	15.0	75.00
129	75	16720	Sept. 29	17.2	76.10	128	220	22222	Oct. 6	15.4	77.00
129	75	16722	Sept. 29	17.4	76.00	128	220	22235	Oct. 6	15.2	80.00
129	75	16726	Sept. 29	17.3	77.30	128	220	22245	Oct. 6	15.4	76.20
129	75	16727	Sept. 29	18.2	79.90	130	217	22286	Oct. 6	16.3	76.90
129	75	16728	Sept. 29	17.0	76.00	130	217	22290	Oct. 6	17.1	78.50
129	75	16730	Sept. 29	17.5	77.30	130	217	22291	Oct. 6	16.5	78.20
129	75	16739	Sept. 29	17.5	76.50	130	217	22292	Oct. 6	16.8	78.60
129	75	16748	Sept. 29	17.7	80.50	130	217	22293	Oct. 6	16.3	76.20
129	75	16750	Sept. 29	18.1	79.10	130	217	22298	Oct. 6	16.3	80.70
129	75	16761	Sept. 29	17.3	76.60	130	217	22305	Oct. 6	16.7	76.30
129	75	16768	Sept. 29	17.7	76.60	130	217	22306	Oct. 6	16.7	76.00
129	75	16780	Sept. 29	17.4	77.70	130	217	22308	Oct. 6	16.9	80.90
129	75	16785	Sept. 29	17.9	78.30	130	217	22309	Oct. 6	16.8	77.80
129	75	16788	Sept. 29	17.1	76.10	130	217	22312	Oct. 6	16.8	80.40
129	75	16796	Sept. 29	17.0	76.30	130	217	22313	Oct. 6	16.5	77.50
129	75	16822	Sept. 29	17.9	77.20	130	217	22314	Oct. 6	16.6	79.00
129	75	16825	Sept. 29	17.5	77.50	130	217	22315	Oct. 6	17.1	80.30
129	75	16827	Sept. 29	17.0	76.30	130	217	22316	Oct. 6	16.7	76.30
129	75	16945	Sept. 29	17.3	76.60	130	217	22320	Oct. 6	16.9	81.30
129	75	16946	Sept. 29	17.3	77.00	130	217	22321	Oct. 6	16.3	78.00
129	75	16951	Sept. 29	16.3	78.00	130	217	22323	Oct. 6	16.9	77.60
129	75	16953	Sept. 29	17.0	78.40	130	217	22338	Oct. 6	17.0	77.30
129	75	16955	Sept. 29	16.6	76.80	130	217	22341	Oct. 6	16.3	80.30
129	75	16959	Sept. 29	16.6	79.40	130	217	22350	Oct. 6	16.4	78.50
129	75	16960	Sept. 29	16.5	80.90	130	217	22351	Oct. 6	16.7	76.30
129	75	16967	Sept. 29	16.9	78.30	130	217	22355	Oct. 6	16.6	77.90
129	75	16982	Sept. 29	17.4	78.00	130	217	22356	Oct. 6	17.7	82.80
129	75	16983	Sept. 29	16.9	77.20	130	217	22360	Oct. 6	16.4	76.30
129	75	17001	Sept. 29	17.0	76.30	130	217	22362	Oct. 6	16.1	81.70
129	75	17003	Sept. 29	17.4	76.90	130	217	22368	Oct. 6	16.3	76.90
129	75	17005	Sept. 29	17.6	78.90	130	217	22369	Oct. 6	16.8	76.40
204	76	17033	Sept. 29	16.6	77.60	130	217	22370	Oct. 6	16.7	77.70
204	76	17034	Sept. 29	17.0	80.00	130	217	22372	Oct. 6	16.6	77.20
204	76	17046	Sept. 29	16.6	77.60	130	217	22373	Oct. 6	16.4	77.30
204	76	17048	Sept. 29	17.7	76.70	130	217	22375	Oct. 6	16.5	84.20
204	76	17049	Sept. 29	17.5	77.50	130	217	22378	Oct. 6	16.4	77.00
204	76	17050	Sept. 29	16.7	77.00	130	217	22381	Oct. 6	16.6	77.60
(*)	562	17618	Sept. 30	16.8	77.10	130	217	22383	Oct. 6	17.2	78.20
(*)	562	17625	Sept. 30	17.5	77.40	130	217	22384	Oct. 6	16.8	77.50
(*)	562	17632	Sept. 30	17.3	79.00	130	217	22386	Oct. 6	16.2	79.00
(*)	562	17635	Sept. 30	16.9	76.90	130	217	22388	Oct. 6	16.5	78.60
(*)	562	17638	Sept. 30	17.4	78.80	130	217	22396	Oct. 6	17.0	77.60
(*)	562	17647	Sept. 30	17.3	76.60	130	218	22408	Oct. 7	16.7	78.10
(*)	562	17652	Sept. 30	16.5	78.20	130	218	22420	Oct. 7	16.0	81.60
(*)	562	17654	Sept. 30	16.6	76.50	130	218	22421	Oct. 7	16.8	78.60
(*)	562	17656	Sept. 30	17.7	77.40	130	218	22428	Oct. 7	16.7	78.10
(*)	562	17662	Sept. 30	17.5	77.20	130	218	22437	Oct. 7	16.3	81.10
(*)	562	17663	Sept. 30	16.6	76.50	130	218	22454	Oct. 7	16.5	77.20
(*)	562	17665	Sept. 30	16.5	76.80	130	218	22461	Oct. 7	16.5	76.40
(*)	562	17675	Sept. 30	17.0	78.00	130	218	22517	Oct. 7	16.7	77.30
(*)	562	17880	Sept. 30	17.2	76.80	130	218	22518	Oct. 7	16.0	81.20
(*)	562	17886	Sept. 30	16.8	76.70	130	218	22522	Oct. 7	16.4	80.80
(*)	562	17887	Sept. 30	17.1	77.80	(*)	562	22819	Oct. 7	16.1	80.10
(*)	562	17707	Sept. 30	17.1	77.50	(*)	562	22823	Oct. 7	16.0	80.00
(*)	562	17725	Sept. 30	17.6	79.70	(*)	562	22834	Oct. 7	16.0	81.60
(*)	562	17726	Sept. 30	16.6	77.60	(*)	562	22835	Oct. 7	16.0	79.20
(*)	562	17734	Sept. 30	17.0	77.30	(*)	562	22836	Oct. 7	16.8	80.00
(*)	562	17735	Sept. 30	16.5	77.20	(*)	562	22837	Oct. 7	16.6	81.00
(*)	562	17757	Sept. 30	17.3	78.70	(*)	562	24749	Oct. 9	15.6	75.30
(*)	562	17758	Sept. 30	16.8	76.70	(*)	562	24754	Oct. 9	15.7	75.80
265	77	21498	Oct. 6	16.5	77.20	(*)	562	24759	Oct. 9	15.5	75.60
265	77	21509	Oct. 6	16.7	78.40	(*)	562	24765	Oct. 9	16.5	78.20
204	76	21520	Oct. 6	17.5	76.50	(*)	562	24769	Oct. 9	15.8	75.60
204	76	21527	Oct. 6	16.5	79.70	(*)	562	24777	Oct. 9	15.8	77.40

* Grown from average seed.

Seed Heads Selected to be Propagated in 1892.

COLMAN'S CANE—Continued.

Parent plat.	Plat.	Serial No.	Date.	Sucrose.	Purity.	Parent plat.	Plat.	Serial No.	Date.	Sucrose.	Purity.
				Per cent.						*Per cent.*	
(*)	562	24778	Oct. 9	15.7	75.80	(*)	562	25625	Oct. 10	16.0	80.00
(*)	562	24813	Oct. 9	16.1	76.70	(*)	562	25627	Oct. 10	16.0	83.30
(*)	562	24829	Oct. 9	15.7	81.80						
(*)	562	24833	Oct. 9	15.8	77.80	Mean of 210 seed heads ...				16.96	78.16
(*)	562	25536	Oct. 9	15.6	84.30	Mean of 18 seed heads				18.29	79.97
(*)	562	25542	Oct. 9	15.5	83.30	Maximum				19.40	84.30

PLANTER'S FRIEND.

106	49	7921	Sept. 16	16.1	75.30	273	78	11596	Sept. 21	18.0	77.30
106	49	7980	Sept. 16	15.5	75.60	273	78	11597	Sept. 21	18.2	81.60
106	49	7999	Sept. 16	16.0	75.50	273	78	11600	Sept. 21	18.0	78.70
273	78	10747	Sept. 19	16.8	75.30	273	78	11602	Sept. 21	18.4	77.00
273	78	10748	Sept. 19	16.5	75.70	273	78	11606	Sept. 21	18.2	78.20
273	78	10749	Sept. 19	17.8	76.70	273	78	11607	Sept. 21	19.0	79.50
273	78	10758	Sept. 19	17.2	75.40	273	78	11608	Sept. 21	19.4	79.20
273	78	10759	Sept. 19	17.3	75.60	273	78	11610	Sept. 21	17.7	77.00
273	78	10760	Sept. 19	17.4	78.00	273	78	11615	Sept. 21	18.1	77.80
273	78	10768	Sept. 19	16.7	75.60	273	78	11616	Sept. 21	18.0	77.30
273	78	10781	Sept. 19	17.8	76.40	(*)	546	13167	Sept. 23	17.3	82.40
273	78	10784	Sept. 19	18.7	77.00	(*)	546	13169	Sept. 23	18.8	87.00
273	78	10788	Sept. 19	17.2	75.10	(*)	546	13230	Sept. 23	17.8	79.20
273	78	10789	Sept. 19	17.3	75.60	(*)	546	13252	Sept. 23	17.8	77.80
273	78	10806	Sept. 19	17.7	76.30	(*)	546	13254	Sept. 23	19.2	78.70
273	78	10807	Sept. 19	16.8	76.40	(*)	546	13278	Sept. 23	18.7	78.20
273	78	10810	Sept. 19	17.5	75.50	(*)	546	13279	Sept. 23	18.2	77.20
273	78	10823	Sept. 19	17.3	75.90	(*)	546	13283	Sept. 23	18.5	78.40
273	78	10833	Sept. 19	17.9	75.60	(*)	546	13299	Sept. 23	18.5	80.10
273	78	10834	Sept. 19	18.2	78.20	(*)	546	13307	Sept. 23	18.5	78.40
273	78	10853	Sept. 19	18.5	76.60	(*)	546	13327	Sept. 23	18.8	79.70
273	78	10858	Sept. 19	17.9	75.20	(*)	546	13397	Sept. 24	19.1	88.00
273	78	11533	Sept. 21	17.6	75.90	(*)	546	13404	Sept. 24	16.8	78.20
273	78	11536	Sept. 21	17.0	76.30	106	49	15638	Sept. 26	17.4	78.80
273	78	11537	Sept. 21	17.8	76.70	273	78	15762	Sept. 28	16.0	82.90
273	78	11540	Sept. 21	17.8	77.80	273	78	15808	Sept. 28	17.4	79.10
273	78	11542	Sept. 21	18.0	75.90	273	78	16551	Sept. 28	18.0	78.80
273	78	11544	Sept. 21	18.5	77.80	273	78	16579	Sept. 28	17.6	77.20
273	78	11545	Sept. 21	17.7	77.00	273	78	16621	Sept. 28	17.8	77.80
273	78	11547	Sept. 21	18.2	78.50	273	78	16643	Sept. 28	18.5	77.40
273	78	11550	Sept. 21	17.9	78.60	106	49	17157	Sept. 29	17.7	78.40
273	78	11551	Sept. 21	18.3	77.00	106	49	17159	Sept. 29	17.0	79.50
273	78	11562	Sept. 21	18.3	77.90	106	49	17162	Sept. 29	17.7	78.10
273	78	11566	Sept. 21	17.6	77.60	106	49	17180	Sept. 29	17.7	77.40
273	78	11580	Sept. 21	18.9	79.40	106	49	17245	Sept. 29	17.0	86.70
273	78	11581	Sept. 21	18.5	78.40	106	49	17246	Sept. 29	17.9	81.30
273	78	11583	Sept. 21	18.2	77.50						
273	78	11584	Sept. 21	18.0	77.60	Mean.....				17.80	77.99
273	78	11592	Sept. 21	17.3	77.30	Mean of 4 heads.....				19.10	81.35
273	78	11594	Sept. 21	18.3	77.90	Mean of 34 heads.....				18.44	78.69
273	78	11595	Sept. 21	18.2	77.20	Maximum.....				19.40	88.00

BLACK AFRICAN.

104	54	5634	Sept. 14	15.5	77.50	(*)	557	6759	Sept. 15	16.1	75.60
(*)	557	6210	Sept. 14	15.3	76.90	(*)	557	6923	Sept. 15	16.1	77.10
(*)	557	6214	Sept. 14	15.3	78.10	(*)	557	6926	Sept. 15	15.7	75.80
(*)	557	6215	Sept. 14	15.2	77.20	(*)	557	6930	Sept. 15	15.8	75.60
(*)	557	6231	Sept. 14	15.3	78.90	(*)	557	6933	Sept. 15	16.8	77.50
(*)	557	6234	Sept. 14	15.2	82.20	(*)	557	6946	Sept. 15	16.2	75.30
(*)	557	6236	Sept. 14	15.0	76.10	(*)	557	6947	Sept. 15	15.7	75.10
(*)	557	6243	Sept. 14	15.0	75.80	(*)	557	6962	Sept. 15	15.5	75.20
(*)	557	6711	Sept. 15	15.4	75.10	(*)	557	6974	Sept. 15	16.1	75.60
(*)	557	6712	Sept. 15	15.0	75.00	(*)	557	6985	Sept. 15	16.1	76.00
(*)	557	6713	Sept. 15	16.0	75.50	(*)	557	6986	Sept. 15	16.6	77.90
(*)	557	6718	Sept. 15	15.8	78.60	(*)	557	6988	Sept. 15	16.2	77.50
(*)	557	6722	Sept. 15	15.5	75.60	(*)	557	6989	Sept. 15	15.7	75.10
(*)	557	6724	Sept. 15	15.9	75.70	(*)	557	6994	Sept. 15	16.8	77.50
(*)	557	6727	Sept. 15	15.7	76.20	(*)	557	6995	Sept. 15	16.2	76.40
(*)	557	6736	Sept. 15	15.9	76.80	(*)	557	6999	Sept. 15	15.5	77.50
(*)	557	6745	Sept. 15	15.9	76.50	(*)	557	7012	Sept. 15	15.7	80.90
(*)	557	6750	Sept. 15	15.6	75.00	(*)	557	7014	Sept. 15	15.7	80.10
(*)	557	6751	Sept. 15	15.7	77.30	(*)	557	7017	Sept. 15	16.1	80.90

*Grown from average seed.

Seed Heads Selected to be Propagated in 1892.

BLACK AFRICAN—Continued.

Parent plat.	Plat.	Serial No.	Date.	Sucrose.	Purity.	Parent plat.	Plat.	Serial No.	Date.	Sucrose.	Purity.
				Per cent.						*Per cent.*	
(*)	557	7024	Sept. 15	15.6	75.70	(*)	557	12125	Sept. 22	16.6	75.80
(*)	557	7035	Sept. 15	15.6	75.70	(*)	557	12129	Sept. 22	18.6	76.60
(*)	557	7036	Sept. 15	15.8	77.10	(*)	557	12130	Sept. 22	16.8	75.00
(*)	557	7039	Sept. 15	15.5	76.30	(*)	557	12135	Sept. 22	17.5	77.30
(*)	557	7041	Sept. 15	15.9	77.90	(*)	557	12137	Sept. 22	16.9	75.10
(*)	557	7043	Sept. 15	15.8	79.40	(*)	557	12145	Sept. 22	16.0	75.10
(*)	557	7050	Sept. 15	15.5	77.10	(*)	557	12160	Sept. 22	17.2	76.80
(*)	557	7051	Sept. 15	15.5	76.70	(*)	557	12161	Sept. 22	16.2	77.80
(*)	557	7053	Sept. 15	15.6	76.80	(*)	557	12164	Sept. 22	17.1	76.10
(*)	557	7055	Sept. 15	15.7	77.00	(*)	557	12165	Sept. 22	18.0	78.00
(*)	557	7056	Sept. 15	15.6	75.00	(*)	557	12166	Sept. 22	18.1	75.70
(*)	557	7062	Sept. 15	16.0	75.50	(*)	557	12168	Sept. 22	17.8	78.10
(*)	557	7064	Sept. 15	15.7	75.50	(*)	557	12174	Sept. 22	17.8	76.00
(*)	557	7065	Sept. 15	16.1	76.70	(*)	557	12176	Sept. 22	16.6	76.10
(*)	557	7067	Sept. 15	15.8	76.70	(*)	557	12185	Sept. 22	16.5	75.70
(*)	557	7074	Sept. 15	15.6	75.00	(*)	564	12222	Sept. 22	16.6	75.50
(*)	557	7080	Sept. 15	15.5	77.10	(*)	564	12229	Sept. 22	17.7	75.30
(*)	557	7083	Sept. 15	15.9	75.70	(*)	564	12230	Sept. 22	17.0	76.30
(*)	557	7084	Sept. 15	15.6	76.80	(*)	564	12232	Sept. 22	16.4	75.20
(*)	557	7085	Sept. 15	15.8	77.40	(*)	564	12233	Sept. 22	16.8	75.70
(*)	557	7184	Sept. 16	15.5	78.30	(*)	564	12234	Sept. 22	16.9	76.20
(*)	557	7188	Sept. 16	15.1	75.90	(*)	564	12236	Sept. 22	16.8	76.00
(*)	557	7189	Sept. 16	15.7	77.00	(*)	564	12239	Sept. 22	17.3	77.60
(*)	557	7192	Sept. 16	15.9	77.60	(*)	564	12240	Sept. 22	16.3	75.20
(*)	557	7196	Sept. 16	15.5	75.20	(*)	564	12242	Sept. 22	16.5	76.80
(*)	557	7197	Sept. 16	15.0	77.30	(*)	564	12244	Sept. 22	16.4	76.70
(*)	557	7203	Sept. 16	15.2	77.90	(*)	564	12245	Sept. 22	17.1	76.70
(*)	557	7208	Sept. 16	15.3	77.30	(*)	564	12246	Sept. 22	16.8	76.70
(*)	557	7211	Sept. 16	15.3	75.00	(*)	564	12247	Sept. 22	17.4	75.60
(*)	557	7218	Sept. 16	15.5	79.10	(*)	564	12248	Sept. 22	17.3	77.00
(*)	557	7225	Sept. 16	15.4	75.50	(*)	564	12250	Sept. 22	16.5	76.80
(*)	557	7226	Sept. 16	15.0	76.90	(*)	564	12251	Sept. 22	17.0	77.00
(*)	557	7250	Sept. 16	15.8	77.40	(*)	564	12252	Sept. 22	16.9	77.60
(*)	557	7251	Sept. 16	15.0	76.00	(*)	564	12261	Sept. 22	17.6	79.30
(*)	557	7261	Sept. 16	15.6	77.20	(*)	564	12262	Sept. 22	16.5	76.80
(*)	557	7264	Sept. 16	15.7	76.60	(*)	564	12265	Sept. 22	17.3	78.00
(*)	557	7268	Sept. 16	15.0	77.30	(*)	564	12268	Sept. 22	17.1	77.10
(*)	557	7276	Sept. 16	15.2	76.40	(*)	564	12269	Sept. 22	17.3	77.60
(*)	557	7278	Sept. 16	15.3	76.10	(*)	564	12271	Sept. 22	17.2	77.50
(*)	557	7280	Sept. 16	15.1	75.50	(*)	564	12541	Sept. 22	17.2	82.30
(*)	557	7283	Sept. 16	15.4	77.40	(*)	564	12546	Sept. 22	17.3	77.30
(*)	557	7284	Sept. 16	15.2	76.40	(*)	564	12549	Sept. 23	17.4	77.40
(*)	557	10881	Sept. 19	16.5	78.60	(*)	564	12554	Sept. 23	17.8	76.70
(*)	557	10904	Sept. 19	16.1	77.80	(*)	564	12558	Sept. 23	17.2	77.10
(*)	557	10911	Sept. 19	16.3	76.90	(*)	564	12560	Sept. 23	18.1	77.80
(*)	557	10926	Sept. 19	16.3	75.50	(*)	564	12563	Sept. 23	17.3	76.00
(*)	557	10929	Sept. 19	16.2	76.40	(*)	564	12577	Sept. 23	17.6	77.20
(*)	557	10931	Sept. 19	16.8	77.10	(*)	564	12582	Sept. 23	17.6	77.20
(*)	557	10937	Sept. 19	16.4	78.50	(*)	564	12583	Sept. 23	17.5	76.10
(*)	557	10938	Sept. 19	16.4	75.90	(*)	564	12585	Sept. 23	17.3	77.00
(*)	557	10941	Sept. 19	16.2	77.50	(*)	564	12589	Sept. 23	17.1	76.70
(*)	557	10942	Sept. 19	16.5	76.30	(*)	564	12592	Sept. 23	17.1	76.00
(*)	557	11979	Sept. 22	16·3	75.80	(*)	564	12594	Sept. 23	17.2	76.10
(*)	557	12006	Sept. 22	16.6	77.20	(*)	564	12606	Sept. 23	17.3	77.30
(*)	557	12007	Sept. 22	16.3	75.20	(*)	564	12689	Sept. 23	17.3	85.20
(*)	557	12018	Sept. 22	17.1	77.10	(*)	564	12693	Sept. 23	17.2	76.50
(*)	557	12020	Sept. 22	16.1	75.60	(*)	564	12694	Sept. 23	17.2	78.50
(*)	557	12021	Sept. 22	16.1	76.30	(*)	564	12699	Sept. 23	17.2	78.20
(*)	557	12026	Sept. 22	16.0	77.30	(*)	564	12702	Sept. 23	17.3	78.70
(*)	557	12035	Sept. 22	17.0	75.20	(*)	564	15356	Sept. 26	16.6	83.00
(*)	557	12039	Sept. 22	17.0	75.40	(*)	564	15398	Sept. 26	16.3	78.00
(*)	557	12053	Sept. 22	16.2	75.00	(*)	564	15410	Sept. 26	16.8	77.10
(*)	557	12081	Sept. 22	17.4	75.00	(*)	564	15415	Sept. 26	16.5	76.80
(*)	557	12084	Sept. 22	16.7	75.30	(*)	564	15440	Sept. 26	16.8	82.80
(*)	557	12092	Sept. 22	17.0	75.60	(*)	564	15451	Sept. 26	16.1	77.40
(*)	557	12095	Sept. 22	16.9	75.20	(*)	564	15464	Sept. 26	16.0	78.80
(*)	557	12098	Sept. 22	17.0	76.70	(*)	564	15467	Sept. 26	16.2	76.10
(*)	557	12100	Sept. 22	17.7	75.30						
(*)	557	12107	Sept. 22	17.0	75.00				Mean	16.35	76.83
(*)	557	12110	Sept. 22	16.5	75.00				Mean of 179 seed heads	16.35	76.83
(*)	557	12113	Sept. 22	17.1	77.10				Mean of 5 seed heads	18.25	77.22
(*)	557	12116	Sept. 22	18.4	78.00				Mean of 50 seed heads	17.38	77.11
(*)	557	12117	Sept. 22	16.8	76.00				Maximum	18.60	76.60
(*)	557	12121	Sept. 22	16.7	76.00						

* Grown from average seed.

Seed Heads Selected to be Propagated in 1892.

COLLIER'S.

Parent plat.	Plat.	Serial No.	Date.	Sucrose.	Purity.	Parent plat.	Plat.	Serial No.	Date.	Sucrose.	Purity.
				Per cent.						*Per cent.*	
117	17	6780	Sept. 15	16.6	77.20	(*)	544	11406	Sept. 21	18.7	77.90
117	17	6798	Sept. 15	16.6	74.90	(*)	544	11409	Sept. 21	18.1	82.60
117	17	6843	Sept. 15	17.1	76.10	(*)	544	11411	Sept. 21	18.3	76.30
114	18	7105	Sept. 16	17.7	76.60	(*)	544	11413	Sept. 21	18.1	76.70
114	18	7111	Sept. 16	17.4	78.00	(*)	544	11414	Sept. 21	18.7	77.00
114	18	7162	Sept. 16	17.0	74.90	(*)	544	11427	Sept. 21	18.4	76.40
114	18	7168	Sept. 16	15.7	79.40	(*)	544	11441	Sept. 21	18.4	76.70
117	84	7638	Sept. 16	15.3	81.40	(*)	544	11456	Sept. 21	18.6	80.10
117	84	7641	Sept. 16	15.8	81.00	(*)	544	11457	Sept. 21	18.5	78.40
117	84	7743	Sept. 16	17.2	76.10	(*)	544	11463	Sept. 21	17.2	76.10
117	84	7749	Sept. 16	17.5	77.90	(*)	544	11464	Sept. 21	18.6	76.20
117	84	7766	Sept. 16	17.2	76.10	(*)	544	11465	Sept. 21	18.8	77.60
117	84	7793	Sept. 16	17.5	77.50	(*)	544	11466	Sept. 21	17.2	77.10
(*)	563	8388	Sept. 17	16.2	76.10	(*)	544	11467	Sept. 21	17.6	76.20
(*)	563	8389	Sept. 17	16.0	76.20	(*)	544	11469	Sept. 21	17.4	77.40
(*)	563	8395	Sept. 17	16.1	76.70	(*)	544	11470	Sept. 21	18.7	78.00
(*)	563	8397	Sept. 16	16.3	76.20	(*)	544	11471	Sept. 21	18.5	77.80
(*)	563	8469	Sept. 17	16.6	76.10	(*)	544	11472	Sept. 21	18.0	77.30
(*)	563	10429	Sept. 19	16.4	76.30	(*)	544	11474	Sept. 21	17.4	78.80
(*)	563	10651	Sept. 19	17.7	77.00	(*)	544	11476	Sept. 21	18.1	77.80
(*)	563	10657	Sept. 19	17.2	77.50	(*)	544	11477	Sept. 21	18.5	78.40
(*)	563	10658	Sept. 19	18.1	79.80	(*)	544	11478	Sept. 21	18.3	76.60
117	17	10663	Sept. 19	18.9	79.40	(*)	544	11479	Sept. 21	18.2	76.50
117	17	10669	Sept. 19	18.2	79.90	(*)	544	11480	Sept. 21	17.8	76.40
117	17	10675	Sept. 19	17.7	77.00	(*)	544	11481	Sept. 21	18.0	76.20
117	17	10678	Sept. 19	17.7	79.40	(*)	544	11482	Sept. 21	17.5	79.90
117	17	10686	Sept. 19	17.6	79.30	(*)	544	11485	Sept. 21	18.8	77.60
117	17	10688	Sept. 19	17.8	76.40	(*)	544	11486	Sept. 21	19.0	77.20
117	17	10692	Sept. 19	18.4	80.00	(*)	563	11641	Sept. 21	18.1	78.40
117	17	10694	Sept. 19	18.0	78.30	(*)	563	11643	Sept. 21	17.6	76.90
117	17	10695	Sept. 19	18.1	78.40	(*)	563	11646	Sept. 21	16.4	75.20
117	17	10714	Sept. 19	19.2	79.00	(*)	563	11648	Sept. 21	16.5	76.40
117	17	10716	Sept. 19	17.6	76.20	(*)	563	11649	Sept. 21	17.0	76.00
(*)	544	11098	Sept. 21	17.4	76.00	(*)	563	11650	Sept. 21	17.4	77.70
(*)	544	11104	Sept. 21	17.2	77.50	(*)	563	11652	Sept. 21	16.9	80.50
(*)	544	11116	Sept. 21	17.0	76.30	(*)	563	11656	Sept. 21	17.6	76.90
(*)	544	11121	Sept. 21	17.4	76.30	(*)	563	11658	Sept. 21	18.2	76.80
(*)	544	11149	Sept. 21	17.5	76.10	(*)	563	11741	Sept. 21	18.0	77.30
(*)	544	11168	Sept. 21	17.0	76.30	(*)	563	11742	Sept. 21	18.2	76.50
(*)	544	11188	Sept. 21	17.4	77.00	(*)	563	11754	Sept. 21	18.4	77.40
(*)	544	11191	Sept. 21	17.7	76.00	(*)	563	11758	Sept. 21	19.0	77.60
(*)	544	11207	Sept. 21	17.2	76.10	(*)	563	11760	Sept. 21	18.7	76.00
(*)	544	11209	Sept. 21	17.2	76.10	(*)	563	11761	Sept. 21	18.4	76.10
(*)	544	11215	Sept. 21	17.7	76.00	(*)	563	11763	Sept. 21	19.0	77.60
(*)	544	11216	Sept. 21	17.0	76.30	(*)	563	11764	Sept. 21	18.0	77.00
(*)	544	11219	Sept. 21	17.6	76.20	(*)	563	11767	Sept. 21	18.8	76.10
(*)	544	11281	Sept. 21	18.2	78.50	(*)	563	11771	Sept. 22	19.2	77.40
(*)	544	11282	Sept. 21	18.0	76.60	(*)	563	11773	Sept. 22	19.1	77.60
(*)	544	11283	Sept. 21	18.0	77.60	(*)	563	11776	Sept. 22	19.4	78.20
(*)	544	11284	Sept. 21	16.8	76.00	(*)	563	11780	Sept. 22	18.9	76.80
(*)	544	11288	Sept. 21	18.1	76.70	(*)	563	11782	Sept. 22	19.1	76.10
(*)	541	11298	Sept. 21	18.8	76.40	(*)	563	11908	Sept. 22	17.5	76.10
(*)	544	11313	Sept. 21	17.7	76.30	(*)	563	11912	Sept. 22	17.9	77.20
(*)	544	11316	Sept. 21	18.2	78.20	(*)	563	11926	Sept. 22	17.7	78.10
(*)	544	11323	Sept. 21	17.2	76.10	(*)	563	11928	Sept. 22	18.1	76.70
(*)	544	11325	Sept. 21	18.1	76.10	(*)	563	11933	Sept. 22	19.1	78.30
(*)	544	11340	Sept. 21	18.5	76.20	(*)	563	11934	Sept. 22	18.6	74.10
(*)	544	11345	Sept. 21	17.8	76.00	(*)	563	11941	Sept. 22	18.1	76.70
(*)	544	11346	Sept. 21	17.9	76.20	(*)	563	11950	Sept. 22	18.6	77.80
(*)	644	11348	Sept. 21	18.2	76.50	(*)	563	11952	Sept. 22	19.2	78.40
(*)	544	11351	Sept. 21	18.3	78.20	(*)	563	11953	Sept. 22	17.2	76.10
(*)	544	11352	Sept. 21	17.6	77.20	(*)	563	11965	Sept. 22	18.1	76.10
(*)	544	11353	Sept. 21	18.7	76.90	(*)	544	12723	Sept. 23	17.8	77.80
(*)	544	11356	Sept. 21	17.8	76.00	(*)	544	12726	Sept. 23	17.3	76.60
(*)	544	11359	Sept. 21	17.0	76.70	(*)	544	12729	Sept. 23	17.2	77.10
(*)	544	11360	Sept. 21	18.0	77.80	(*)	544	12731	Sept. 23	17.4	76.90
(*)	544	11362	Sept. 21	18.6	77.90	(*)	544	12752	Sept. 23	17.1	76.70
(*)	544	11367	Sept. 21	18.5	77.20	(*)	544	12775	Sept. 23	18.0	77.30
(*)	544	11372	Sept. 21	17.4	76.90	(*)	544	12785	Sept. 23	17.8	76.70
(*)	544	11373	Sept. 21	18.5	80.40	(*)	544	12789	Sept. 23	17.5	76.80
(*)	544	11375	Sept. 21	18.2	77.50	(*)	544	12791	Sept. 23	17.9	76.20
(*)	544	11380	Sept. 21	18.5	76.80	(*)	544	12794	Sept. 23	18.4	77.40
(*)	544	11381	Sept. 21	17.5	76.10	(*)	544	12795	Sept. 23	17.6	77.20
(*)	544	11383	Sept. 21	18.2	76.10	(*)	544	12799	Sept. 23	17.6	77.60
(*)	544	11385	Sept. 21	17.7	76.00	(*)	544	12805	Sept. 23	17.3	76.60
(*)	544	11396	Sept. 21	18.5	77.40	(*)	544	12813	Sept. 23	17.4	76.90
(*)	544	11398	Sept. 21	18.8	78.30	(*)	544	12819	Sept. 23	18.6	76.60
(*)	544	11399	Sept. 21	18.7	80.20	(*)	544	12830	Sept. 23	18.1	76.40

*Grown from average seed.

Seed Heads Selected to be Propagated in 1892.

COLLIER'S—Continued.

Parent plat.	Plat.	Serial No.	Date.	Sucrose.	Purity.	Parent plat.	Plat.	Serial No.	Date.	Sucrose.	Purity.
				Per cent.						*Per cent.*	
(*)	544	12845	Sept. 23	18.4	80.00	(*)	563	15333	Sept. 26	18.2	76.50
(*)	544	12850	Sept. 23	17.9	76.50	(*)	594	15926	Sept. 28	16.2	75.00
(*)	544	12877	Sept. 23	18.0	76.60	(*)	594	15934	Sept. 28	16.2	75.70
(*)	544	12878	Sept. 23	18.8	78.30	117	84	17567	Sept. 29	18.0	79.00
(*)	544	12884	Sept. 23	17.6	77.90	117	84	17572	Sept. 29	17.8	77.80
(*)	544	12885	Sept. 23	17.6	77.90	117	84	17574	Sept. 29	17.5	76.50
(*)	544	12887	Sept. 23	18.7	77.00	117	84	17576	Sept. 29	17.9	76.50
(*)	544	12888	Sept. 23	18.8	80.60	117	84	17578	Sept. 29	17.6	76.90
(*)	544	12894	Sept. 23	17.2	76.10	117	84	17587	Sept. 29	18.4	78.00
(*)	544	12896	Sept. 23	18.0	76.60	117	84	17589	Sept. 29	17.7	76.60
(*)	544	12897	Sept. 23	16.2	76.40	117	84	17591	Sept. 29	18.2	77.50
(*)	544	12899	Sept. 23	18.0	77.30	117	84	17593	Sept. 29	17.6	76.90
(*)	544	12900	Sept. 23	18.1	76.70	114	112	21617	Oct. 6	16.5	77.20
(*)	544	12903	Sept. 23	17.7	76.60	114	112	21621	Oct. 6	16.5	77.80
(*)	544	12912	Sept. 23	17.7	76.60	114	112	21623	Oct. 6	16.1	77.10
(*)	544	12915	Sept. 23	17.8	76.70	117	113	21709	Oct. 6	17.0	78.70
(*)	544	13010	Sept. 23	17.5	78.40	117	113	21710	Oct. 6	16.5	78.20
(*)	544	13029	Sept. 23	18.0	77.30	117	113	21711	Oct. 6	16.0	76.20
(*)	544	13030	Sept. 23	17.8	76.00	117	113	21712	Oct. 6	16.0	77.30
(*)	544	13035	Sept. 23	18.1	77.40	117	113	21719	Oct. 6	16.3	76.20
(*)	544	13046	Sept. 23	19.1	76.70	117	113	21742	Oct. 6	17.0	78.00
(*)	544	13070	Sept. 23	18.3	76.30	117	113	21749	Oct. 6	17.0	76.30
(*)	544	13076	Sept. 23	18.5	77.10	117	113	21750	Oct. 6	16.6	76.50
(*)	563	14069	Sept. 24	17.1	76.70	274	108	21830	Oct. 6	16.5	77.80
(*)	563	14070	Sept. 24	18.2	77.50	274	108	21860	Oct. 6	16.5	76.80
(*)	563	14078	Sept. 24	18.0	78.30	116	101	21873	Oct. 6	16.4	77.00
(*)	563	14368	Sept. 25	16.3	77.50	116	101	21875	Oct. 6	16.7	76.00
(*)	563	14934	Sept. 25	17.9	76.10	116	101	21886	Oct. 6	17.1	76.40
(*)	563	14939	Sept. 25	18.8	79.30	116	101	21900	Oct. 6	16.2	76.40
(*)	563	14944	Sept. 25	17.5	76.10	116	101	21912	Oct. 6	16.2	77.10
(*)	563	14980	Sept. 25	17.6	76.50	116	101	21926	Oct. 6	17.1	77.10
(*)	563	14982	Sept. 25	17.9	76.50	114	100	22541	Oct. 7	16.7	76.00
(*)	563	14983	Sept. 25	17.6	76.20	114	100	22543	Oct. 7	16.8	76.40
(*)	563	14984	Sept. 25	18.7	77.90	114	100	22548	Oct. 7	16.8	76.40
(*)	563	14985	Sept. 25	18.0	75.00	114	100	22558	Oct. 7	16.0	76.60
(*)	563	15017	Sept. 25	17.8	79.50	114	100	22573	Oct. 7	16.3	77.30
(*)	563	15038	Sept. 26	18.9	76.80	114	100	22574	Oct. 7	17.0	76.00
(*)	563	15047	Sept. 26	18.1	76.10	114	100	22591	Oct. 7	17.1	76.40
(*)	563	15222	Sept. 26	17.5	78.20	114	104	22600	Oct. 7	17.8	87.70
(*)	563	15233	Sept. 26	18.1	76.60	114	104	22606	Oct. 7	17.0	76.70
(*)	563	15236	Sept. 26	18.6	77.80	114	104	22641	Oct. 7	17.6	79.70
(*)	563	15245	Sept. 26	18.3	76.30	114	104	22686	Oct. 7	17.5	77.30
(*)	563	15248	Sept. 26	18.9	77.20	274	449	23342	Oct. 7	16.7	81.50
(*)	563	15257	Sept. 26	17.6	78.30	274	449	23382	Oct. 7	16.8	75.00
(*)	563	15261	Sept. 26	18.4	80.70	274	449	23419	Oct. 7	16.5	77.80
(*)	563	15268	Sept. 26	18.0	78.30	274	449	23431	Oct. 7	16.8	76.40
(*)	563	15277	Sept. 26	18.2	76.50	274	449	23443	Oct. 7	16.0	76.20
(*)	563	15279	Sept. 26	17.7	77.40	274	449	23448	Oct. 7	17.5	77.90
(*)	563	15296	Sept. 26	18.0	75.60	274	449	23468	Oct. 7	16.8	78.60
(*)	563	15301	Sept. 26	18.1	77.10	274	449	23470	Oct. 7	16.1	77.10
(*)	563	15303	Sept. 26	18.5	76.60						
(*)	563	15309	Sept. 26	17.8	76.70	Mean of 261 seed heads....				17.69	77.21
(*)	563	15319	Sept. 26	18.3	78.20	Mean of 11 seed heads.....				19.10	77.64
(*)	563	15321	Sept. 26	17.8	77.00	Mean of 48 seed heads.....				18.78	77.61
(*)	563	15323	Sept. 26	17.8	76.00	Maximum.....				19.40	78.20

*Grown from average seed.

LINK'S HYBRID AND AMBER.

59	447	23282	Oct. 7	15.9	77.60	8 *x*	471	23549	Oct. 8	16.8	76.70
59	447	23286	Oct. 7	15.8	75.20	8 *x*	471	23553	Oct. 8	16.3	75.20
59	447	23288	Oct. 7	16.2	76.10	8 *x*	471	23573	Oct. 8	16.5	76.10
59	447	23296	Oct. 7	16.4	76.30	8 *x*	471	23574	Oct. 8	16.5	76.10
59	447	23297	Oct. 7	16.5	77.50	8 *x*	471	23576	Oct. 8	16.8	76.00
59	447	23300	Oct. 7	15.9	75.00	8 *x*	471	23580	Oct. 8	16.8	76.00
59	447	23306	Oct. 7	15.6	76.10	8 *x*	471	23582	Oct. 8	17.0	76.70
59	447	23307	Oct. 7	15.9	75.40	8 *x*	471	23589	Oct. 8	16.8	79.20
59	447	23312	Oct. 7	16.7	82.70	8 *x*	471	23590	Oct. 8	16.6	75.50
59	447	23315	Oct. 7	17.1	76.10	8 *x*	471	23598	Oct. 8	16.2	75.70
59	447	23316	Oct. 7	15.6	77.60	8 *x*	471	23610	Oct. 8	16.8	75.30
165 *x*	481	23511	Oct. 8	15.0	75.00	8 *x*	471	23613	Oct. 8	16.2	77.50
165 *x*	481	23514	Oct. 8	15.3	76.10	8 *x*	471	23616	Oct. 8	16.8	78.20
8 *x*	471	23522	Oct. 8	16.5	75.00	8 *x*	471	23623	Oct. 8	16.2	75.00
8 *x*	471	23534	Oct. 8	16.0	75.10	8 *x*	471	23627	Oct. 8	16.3	75.50
8 *x*	471	23538	Oct. 8	16.6	75.80	8 *x*	471	23628	Oct. 8	16.6	75.80
8 *x*	471	23546	Oct. 8	16.7	79.20	8 *x*	471	23631	Oct. 8	16.9	75.20

Seed Heads Selected to be Propagated in 1892.

LINK'S HYBRID AND AMBER—Continued.

Parent plat.	Plat.	Serial No.	Date.	Sucrose.	Purity.	Parent plat.	Plat.	Serial No.	Date.	Sucrose.	Purity.
				Per cent.						*Per cent.*	
8 *x*	471	23653	Oct. 8	16.6	76.80	269	496	23795	Oct. 8	14.8	75.10
8 *x*	471	23658	Oct. 8	16.7	75.60	269	496	23826	Oct. 8	16.3	75.20
8 *x*	471	23672	Oct. 8	16.8	75.30	23 *x*	509	23965	Oct. 8	16.1	76.00
8 *x*	471	23678	Oct. 8	15.6	75.00	23 *x*	509	24059	Oct. 8	17.0	74.90
8 *x*	471	23680	Oct. 8	16.1	75.30	23 *x*	509	24077	Oct. 8	16.0	75.10
8 *x*	471	23696	Oct. 8	16.3	76.60	110 *x*	511	24106	Oct. 8	15.4	75.80
8 *x*	471	23699	Oct. 8	16.1	76.00	8 *x*	406	25105	Oct. 9	15.5	79.50
8 *x*	471	23700	Oct. 8	16.6	75.10	14 *x*	407	25214	Oct. 9	15 5	78.70
8 *x*	471	23702	Oct. 8	16.7	75.30	341 *x*	416	25313	Oct. 9	15.6	75.00
8 *x*	471	23716	Oct. 8	17.1	75.40						
269	496	23790	Oct. 8	14.7	77.30	Mean				16.22	76.28
269	496	23793	Oct. 8	14.7	77.80						

LINK'S HYBRID AND AMBER CROSS.

59	29	15052	Sept. 26	17.1	76.40	50	79	8163	Sept. 17	16.2	75.70
59	29	15056	Sept. 26	17.4	78.00	50	79	8174	Sept. 17	15.4	75.50
59	29	15057	Sept. 26	17.6	76.50	50	79	9467	Sept. 18	15.9	77.20
59	29	15063	Sept. 26	17.8	76.40	50	79	9470	Sept. 18	15.9	75.00
59	29	15064	Sept. 26	17.9	76.50	50	79	11503	Sept. 21	16.6	77.90
59	29	15056	Sept. 26	18.3	78.20	50	79	11504	Sept. 21	15.1	76.30
59	29	15071	Sept. 26	18.0	77.60	50	79	11505	Sept. 21	15.5	75.20
59	29	15088	Sept. 26	17.4	77.00	50	79	11507	Sept. 21	15.7	75.70
59	29	15111	Sept. 26	17.8	78.10	50	79	11515	Sept. 21	16.5	75.10
59	591	18086	Sept. 30	16.3	75.50	50	79	11522	Sept. 21	16.8	77.10
59	591	18113	Sept. 30	16.4	75.90	50	79	11524	Sept. 21	16.8	75.70
59	591	18140	Sept. 30	16.0	76.20	50	79	11526	Sept. 21	16.5	76.80
59	591	18144	Sept. 30	17.4	75.60	50	79	11527	Sept. 21	15.8	75.60
59	560	23052	Oct. 7	16.4	76.70	50	79	11528	Sept. 21	16.6	76.10
59	560	23053	Oct. 7	16.5	78.20						
59	591	25403	Oct. 9	15.2	75.20	Mean of 14 analyses				16.09	76.07
Mean of 16 analyses				17.09	76.75	Maximum				16.80	77.90
Maximum				18.30	78.20						

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