

CHAPTER I

THE LITERATURE

In the literature, I have taken a cross-section of the writings having to do with the development and progress of the Louisiana Sugar Industry covering ninety-nine years. This material has been gathered from a number of well known journals, most of which have no index. The literature is quoted and is presented in chronological order. This material is presented partly to bring it together in a convenient manner for what it may be worth, and partly for ready reference in the discussion which will follow. There are other publications which throw much light on the subject. They are pamphlets, bulletins, and books which are accessible, and to a large degree modern. Such material from them as is used will be referred to in the usual manner.

According to De Bow's Review, Vol. 1, page 48, which was published in 1845, "The statistics from 1803 to 1817 are so difficult that no measure of progress can be made." The first commercial crop of sugar was not produced until 1796, and while it is said that planters freely followed the lead of De Bore, and it is known that in 1815 the crop amounted to about 5,000 short tons, it was not until about 1830 that our records begin to show much that is of interest to us in this work. In that year (1830), the Secretary of the United States

Treasury (Article 1) sent out a questionnaire to a number of sugar planters in which he asked for information on the culture of sugar cane. Questions five, eight, and nine are of interest to us; and the answers as given by two Louisiana planters are quoted:

By Manual Andry of New Orleans

Question Five- The Best Mode of Cultivating the Cane. (1)*

"The ground is plowed as deep as possible, and harrowed; and after it has been thus broken up, parallel drills or furrows are plowed at a distance of two and one-half feet to four feet from one another; in these the cane is laid lengthwise and covered about an inch with a hoe. Small canals to drain off the water are commonly dug more or less distant from each other, and these are crossed by small drains, so as to form squares like a checker board. These ditches are necessary to drain off the water from rains, as well as that which filters from the river, which would otherwise remain upon the plantation."

Question Eight- The Average Quantity of Sugar Which Can Be Made from a Given Quantity of Land, etc.

"The average quantity of sugar that can be produced upon an acre of land of proper quality, well cultivated, is from 800 to 1,000 pounds, provided that the cane has not been damaged either by storm, or wind, inundation or frost."

Question Nine- The Number of Hands Required to Cultivate a Given Quantity of Land.

"Two qualities of land are observed on the banks of the Mississippi in Louisiana, a strong or compact soil and a lighter soil.

The strong soil is the easiest for cultivation, and most productive in rainy seasons. The light soil requires less labor and yields more readily in a rainy season. To these

*Numbers refer to bibliography at end of thesis.

differences, others are to be added, resulting from the different exposures of land, the greater or less facility of draining them, and also from the greater or less quantity of weed, known as coco or nut grass. It results from this statement that the cultivators, who observe but superficially, differ strangely upon the number of hands it is necessary to have to cultivate a given quantity of cane, as well as upon the product to be obtained. In answering the question, we will endeavor to approach the truth as near as possible.

X Sixty working hands are necessary to cultivate 240 acres of cane in well prepared land, and to do all the work necessary until the sugar is made and delivered. The sugar up to the moment it is delivered "costs" the sugar planter about three and one-half cents per pound for expenses incurred, without reckoning the interest on his capital."

By F. Henderson (German Coast)- September 25

X Question Five-

"If the soil is alluvial, it ought to be well ditched, so that the cane may all be two or three feet above the level of the water in the ditches. According to the quality of the land, the cane ought to be planted from two to four feet apart, allowing the greatest distance in the richest soil: it is laid in drills made with a common plow lapped only if the land is new and if it has not been long in cultivation. The cane is afterwards covered sufficiently to protect it from the frost and ice. (You may plant any time from the middle of September to the middle of March) The fall planting, I look upon as the safest or best, because in case of a cold winter the cane is safer in the ground than in mattelasses; and further, because a great deal of the Fall planting may be done with the tops which are otherwise thrown away."

Question Eight-

"Let us suppose a plantation of 750 acres of land (sugar) well ditched and in a high state of cultivation, between latitude 29-30. 500 acres of it would be planted in cane, and the remainder in corn or beans: of the five hundred acres of cane, 200 would be plant cane; 200 first year rattoon stubble cane and 100 second year stubble cane; the last 100 acres being generally thin, small and short jointed would be put up in mattelasses for plant. The remaining 400 acres would be converted into sugar, and one hogshead of a 1,000 pounds per acre would be considered a good average crop. The

corn and beans are given to the slaves, and are not sufficient for them one year in ten.

~~The number of hands required to work the plantation in the foregoing answer would be 100 field hands."~~

1845

Louisiana Sugar 1845

(2)

"The cane is now cultivated and worked into sugar in nineteen parishes: West Baton Rouge, East Baton Rouge, Iberia, Ascension, St. James, St. John, St. Charles, St. Bernard, Jefferson, Plaquemines, Assumption, Lafourche, Terrebonne, St. Mary, St. Martin, Lafayette, Vermilion, and St. Landry.

Large preparations are being made to plant cane in the cotton parishes of Rapides, Avoyelles, Concordia, and Calcasieu.

Enough sugar could be produced to supply the United States, and, if drainage were put in, a surplus for export to Europe.

First cane sugar was sent to the mother country from the plantation of Chevalier de Mazan, which was near the City on the opposite bank of the river. The yield was three thousand pounds and equal to that of St. Domingo Muscavado. The cession of Louisiana to Spain put an end to the infant industry.

~~Mr. De Bore's crop of \$12,000 worth was made in 1796 at Carrollton. Cattle was the only power to turn the mills to date."~~

1846

Louisiana Sugar, Article III

(3)

"The seed seldom yields more than four fold, hardly ever more than five. The very smallest quantity of cane required to plant 100 acres is 20 acres of the finest cane, and if, as is too frequently practiced, the smallest and poorest cane is saved for planting, it is necessary to put up 30-40 and sometimes 50 acres in order to plant 100 acres.

~~Rotation consists of plant cane, 1st Stubble, 2nd Stubble, Plant Cane."~~

This article suggests that; "the use of poor seed cane is responsible for the deterioration of that wonderful cane, Creole."

"Crowding cane causes it to not ripen."

"Cane is planted in eight foot rows, using three running stalks placed about four inches apart."

"Believes that it is best to burn trash."

Signed: J.P.B.- (J. P. Benjamine)

1847

De Bow's Review

(3a)

"That barring the stubble too close of earth in the spring is an injurious practice: as the buds of young sprouts are mainly dependent on the moisture derived from the soil for the growth, until it puts fourth roots of its own."

1847

De Bow's Review

(4)

"Land that has already borne cane should be plowed deep, and thrown into high beds. With a deep narrow plow and two horses, run on the bed (open). If the land is new, put in a cane and a half, six feet apart. If old put in two canes six feet apart. Cover deep or shallow to suit the fancy. If deep, scrape early. In cultivating stubble, barr off as close as possible. Best way to preserve the stubble is to use trash and burn off in early March."

Col. A. O'Brien

1847

Agriculture and Manufacture- South and West

(5)

"The eighth is a memorial signed by several hundred planters of Louisiana, dated in 1842, praying an increase of duty on imported sugar. (extract)

That the number of sugar estates in Louisiana amounts to 308.

That under the Tariff of 1816, the State of Louisiana was already supplying one half of the sugar required for the consumption of the United States, and was bidding fair soon to meet the entire consumption.

That before the last 383 estates could be brought into full operation, the tariff of 1833 was adopted. That 156 estates have already been compelled to abandon their sugar works under the effects of this Act."

1847

From a Planter in Louisiana
Elm Hall

(6)

"----Yet, although my entire energies have been, for the past eight years, to the culture and manufacture of sugar cane, I have not the vanity to think myself capable of teaching others and feel that we could have no more valuable bond, than a good scientific treatise on the various parts of the subject you propose. However, if I have been able to make any advances in any one branch of the subject, it has been in the cultivation. I believe that planters of this State are indebted to me for the truly philosophical mode of giving distance to cans, viz., by planting rows of corn, or two rows of cane and one of corn, etc., thereby allowing space for the sun and air to reach the stocks - of course producing a rich and more perfect cane-juice, by ripening sooner and more thoroughly. The above mode of planting is calculated for new lands, that would grow canes too large and rank to ripen when planted the ordinary distance apart; but the same principle holds good on any quality of land, viz., plenty of distance to admit sun and air to the stock.

It would take a book to do into all of the particulars and reasons for the various items appertaining to the culture of a crop of cane. My own experience confirms me in the following truths, to be acted on before any certainty can be calculated on in the planting of cane, viz.; The land must be drained thoroughly with ditches not more than a half acre, and of a depth not less than three feet. Secondly, the land must be broken up deeply, say ten inches or a foot, early in January, or which is better, in the fall previous to planting and replowed until the soil is perfectly pulverized. Thirdly, during the cultivation, the cane is to be plowed frequently, (when not too wet) until large enough to receive the final hillling; and if the proper distance, (viz., not less than eight feet between rows) are given, the crop is insured, so far as the planter has it in his power. When the land becomes worn, it must, of course, be manured in some way- planting cow peas."

1847

Cultivation of the Sugar Cane
R. A. Wilkinson

(7)

"Cane is a very exhaustive crop, therefore, it requires that a very large return should be made of that food used by the cane in its production. A plantation should always have a deep front ditch running by the front fence the full length of the plantation, from three to four feet wide and from three to four feet deep. From the upper to the lower line, every acre apart a ditch four feet wide

and from three to four feet deep should leave the front ditch taking the most direct route to the back canal. Every half acre apart from the front fence to the back canal, should have a ditch parallel to the fence, one foot and one and a half feet wide, to carry the water from the cane furrows to the leading ditch.

But the greatest of all improvements in this way is the drainage machine, which I have seen keeping six hundred acres of land in an adjoining plantation, clear of water, the water outside of the flood-gates being twenty-four inches higher than upon the inside.

* The next in importance is the renewal of land by manure, and as an opinion is gaining ground that the cane trash is sufficient to keep lands up alone, I must say that I have not found it so. Though on old lands the cane trash may be much used, and upon new, the ashes are more so; still, this alone will not renew old lands, if placed there forever. I have worked, for four or five successive years, cuts along side of the same kind in cane, the one trash plowed under, the other burned and plowed immediately, I could see no difference, whatever; last year they were the same, both indifferent, as the season was bad, giving very little over a hogshead each. Not so the land out one year in peas; and that out two years in peas, on an adjoining place below me, upon which the trash had been given up for peas and deep plowing, and on this land the cane was magnificent, and admired by all; at least one hundred and twenty acres in one body, an old coco ground in cultivation for twenty five years; we formerly failed in making this land produce when I lived there, by planting peas with the corn; it was of some service, but cannot bring up exhausted lands. Peas were then tried without corn for two years, and that was all well turned and the result has been perfectly satisfactory."

1847

Sugar Culture and Manufacture in Louisiana
and West Indies. Valcour Aime, (8)

"As to the culture of the cane in the Fields, I have nothing new to notice. An actual progress has been made of late years in the management of our sugar plantation; but is due to a series of small and gradual improvements, which would be too tedious to detail. The most prominent one, however, consists in the placing the cane rows at a much greater distance from one another than was formerly done. By that means they can now do with the plow about three fourths of the weeding for which the hoe alone was heretofore put in requisition."

From De Bow's Review

(9)

"In Louisiana, whose resources and progress have been extraordinary, it is scarcely credible how little interest has been taken in the subject of scientific agriculture. Accounts on all hands are agreed that, until within a few years, the rudest systems of tillage were in use, and the most wasteful."

J. P. Benjamin

De Bow's Review

(10)

"On all sides evidence of improvement are becoming conspicuous, and although much still remains to be done, although in many matters our culture and manufacture are still in their infancy."

1848

Production, Etc. of Sugar Cane

J. C. Delavigne

(11)

X "In new lands it is well to give the cane more space, either placing the rows eight or nine feet apart, or at six feet, leaving out every third row to be planted in corn. The richer the land, the further apart they should be planted to give them sunshine and air. There are several advantages obtained by planting the rows wide apart. It admits of plowing between the rows with two horse plows, and it diminishes the number of rows to be cultivated, causing an economy of labor. The canes grow larger and heavier, compensating in size for the reduced number. The first plowing should be done with a small plow, the mould board turned off from it, in order not to hurt the young plants, and to run as near as possible to the roots. The next furrow should be run turning the mould board the other way, so as to throw the dirt back into the first. At the second plowing, one furrow more should be run, making a space about two feet in width of stirred ground on each side of the row. By this time the cane will be high enough to admit of throwing the dirt to its feet. A large plow should now be used to hill it up, turning the mould board towards the row, and avoiding unnecessary cutting of the roots, if the ground be in good order, by passing at a distance of at least one foot. A part of this operation, however, will have to be done with the hoe. The quantity of arpents which one plowman can attend to is about fifteen, without taking into account the work of the hoe, which is done by another hand."

1852

The Sugar Interest
W. F. W.

(12)

X "Some say there is nothing new under the sun.---- A gentleman has this year planted cane upon a principle, which I think is new to most of us. It is this: the canes are cut in pieces of four or five joints, each joint having a good eye. It is then planted in hills, or to make it more intelligible, the furrow is plowed twice so as to make it one foot wide. On each side is laid a piece of this cut cane, say nine inches apart and directly in line opposite each other, but longitudinally with the furrow. At a space of two or two and a half feet, other pieces are planted, and so on through out the soil. The crop is covered and worked in the ordinary manner."

1854

Guano in Cane Fields (From a late number of the
New Orleans Delta)
Victor T. Forestall's Diary (13)
St. James- March 31, 1853

"Opened a furrow between two rows of cane, put in a trace of guano, and covered the same by plow; prepared in the same way about 25 arpents, using about two hundred and twenty five pounds of guano to the arpent.

Opened a furrow close to each row of cane, each side applied the guano in the same manner, and putting in the same amount as above and twenty-five arpents.

The above two pieces of land are selected for an experiment, because of their requiring renovation, and being used this season not to lose extra plant-cane remaining.

March, 1854. Results - The above fifty arpents of guano cane turned out and largest and heaviest cane in the field and produced 1st and 2nd clarified sugar - 2,500 pounds per arpent. On the same ground I have never before obtained more than 1,000 pounds per arpent, and the canes were always small compared to other parts of the field. With Guano, I feel confident, no rotation of crops is required to produce the finest and heaviest canes in Louisiana."

Frank Lapiees' Diary - St. James

"April 27, 1853. Guano on plant cane. Selected my worst cow land in five different parts of the field, on which I never had been able to obtain a large cane and a good stand; opened furrows, close to each row, six feet apart, put in a trace of guano, say one hundred and fifty pounds per arpent, covering the same with a plow, in twenty-five arpents, had a good shower immediately after.

June 3, 1853. On this day no difference perceivable, added 150 pounds guano per arpent.

June 16, 1853. Difference between the guano cane and other cane in the field quite apparent, being of a deep green, and fully one foot higher than all other canes.

August 1, 1853. Never saw a heavier stand or higher cane in this State than the guano cane on this date.

October 26, 1853. Guano cane all laid down flat.

December 15, 1853. Ground five arpents of the above cane, which weighed 10 B. while other cane in the field only weighed $8\frac{1}{2}$. These produced 2,000 pounds to the arpent of refined sugar.

June 16, 1853. Rattoons, Applied as an experiment, 200 pounds to two arpents of inferior rattoons; rain came on immediately afterwards.

Note: These Rattoons soon afterwards shoted out rapidly, and produced double the quantity of cane of other rattoons in the same piece, and double the size.

March 16, 1884. The guano rattoons have already a full stand, and are comparatively the finest in the field. So much so that I am preparing to apply some guano to as large a portion of the rattoons as I may be permitted to do."

1855

Culture and Consumption of Sugar
P. L. Simmonds

(14)

"Production in the United States.- Sugar culture in the United States, is a subject of increasing interest. The demand is rapidly advancing. Its production in the State of Louisiana, to which it is there principally confined, is a source of much wealth. In 1840, the number of slaves employed in sugar culture was 149,890, and the production, 119,947 hogsheads of 1,000 pounds each; besides 600,000 gallons of molasses. Last year the crop exceeded 240,000 hogsheads worth \$12,000,000. The capital now invested is \$75,000,000. The protection afforded by the American tariff has greatly increased the production of sugar in the United States. From 1816 to 1850 this increase was from 15,000 hogsheads to 250,000 hogsheads."

In 1843, the State Of Louisiana had 700 plantations, 525 in operation, producing 90,000 hogsheads. In 1844, the number of hogsheads was 191,324, and of pounds, 204,913,000; but this was exclusive of the molasses rated at 9,000,000 gallons. In 25 parishes; 1,240 sugar houses, 630 steam power, 610 working horse power; and the yield of sugar was 186,650 hogsheads, or 207,337,000 pounds.

1855

New Variety of Sugar Cane- (Extract from a letter from a Louisiana Planter)

(15)

"From a communication of the Hon. J. Balustier to the Agricultural branch of the Patent Office, published in your last Review, I am reminded that in 1850 and 1851 I wrote several letters to the department urging them to procure several different varieties of sugar cane and several other plants. As you are connected with the department, no doubt you could be of great service to the planters of Louisiana in procuring a new variety of sugar cane. It is of vast importance to the sugar interest; for several years, the canes have decayed before planting, and for the last two years, the greatest portion of the cane on some plantations has become rotten before planting. The sugar cane is no exception to the law of vegetable physiology, that plants propagated a great length of time from buds become feeble, and finally run out."

1855

The Sugar Growth in Louisiana

(16)

Charles Gayarre quotes Judge Martin.- "Since the year 1766 the manufacture of sugar has been entirely abandoned in Louisiana. A few individuals had, however, contracted to plant a few canes in the neighborhood of the City."

1856

The Sugar Crop of Louisiana

(17)

"The coming crop will doubtless be the smallest in proportion to the extent of ground cultivated, that has occurred since 1835, when the yield was estimated at over 30,000 hogsheads. There had been a gradual changing, for some years past, from the sugar culture to that of cotton, for we find by Mr. Champomier's statement that, while 1852 there were 1,481 sugar houses, in 1855 the number had been reduced to 1,299; showing a decrease in three years of 182. We also know that there had been a further material decrease this year, but the great falling off in the crop is referable to the damage from the remarkable continuance of cold and wet weather during the past winter, by which the rattoons or stubbles were almost entirely destroyed, as well as much of the plant cane, before or after planting. Under these circumstances some planters plowed up their fields and planted corn or cotton, or both, and will have no cane. Others will perhaps make enough to replant for another crop, while some having light soils or well drained lands, and having been favored by seasonable showers, may approach a fair average. These will have an excess of cane beyond their requirements for planting, but whether they will sell from their excess, to those wanting plants, instead of making sugar, and to what extent, we have no means of estimating. At all events the crop must be a short one - doubtless the shortest since 1843 - as the extreme estimate named is 125,000 hogsheads, while some mark as low as 89,000 hogsheads, an amount altogether insufficient for the requirements of the west alone, and calling for an unusually large import of foreign sugar. In accounting for the decline in the production for years past, it is probable that it may be in some degree (possibly a very important one) attributed to the deterioration of the plant from the partial exhaustion of the peculiar qualities of the soil necessary for its sustenance. Should this be the case it would be well for the planters to supply the deficiency by the application of the proper manures.

1857

The Sugar Interest
Mr. Taylor

(18)

"In 1854, then according to the estimates of McCulloch and Simonds, nearly one fourth of all the sugar produced upon the face of the globe was made in the State of Louisiana."

1857

The Sugar Crop and Sugar Duties
Hon. Miles Taylor

(19)

"----And when it is as nearly certain as anything in the future can be, that the crop now planted in Louisiana will be the largest ever made in the State.

I know Mr. Chairman, that this declaration of mine as to the crop which will likely to be grown in Louisiana the present year will excite surprise in the minds of those who infer from the appropriation made last year for the procuring of sugar cane, for renewing the seed in Louisiana, that the plant had deteriorated there; but, Sir, it is never-the-less true. The cane in Louisiana has not deteriorated, and I have had some little experience on the subject. The cane crop for the present year is planted with Louisiana cane; and my information from that State now is that the plant cane was never better than this year, and that the crop now planted greatly exceeds any ever before planted there. And, Mr. Chairman, allow me to observe that this appropriation, in consequence of some of the declared enemies of the sugar culture have taken advantage to deoy that culture is a forced one in the United States, and altogether precarious in its results, was, I will not say a buncombe affair, but it was one which was occasioned by newspaper representation coming from the inxperiences, grew out of a desire to conciliate public sentiment, and was, in my view, of doubtful expediency, and more that doubtful in principle. I say it was of doubtful expediency because the cane which has been cultivated for many years in Louisiana, in my opinion, is better fitted to the production of certain and large crops of sugar than any which would likely to be introduced. But, Sir, all plants transferred from one climate to another, if they flourish in the new climate at all, undergo certain changes in their period of growth, which adapt them more and more to their new abode. This has taken place in a remarkable degree with the ribbon cane in Louisiana. It now goes through the various stages of its growth in a shorter period each year than it did formerly; and it is a fact which is attested by the experience of all the older planters of Louisiana that in consequence of this the cane attains its full growth, and ri-

pened so much earlier in the autumn that the season of converting its juice into sugar has been lengthened upon an average of from fifteen to twenty days."

1857

The Sugar Expedition

(20)

"An expedition similar to that which has been sent to Arabia and Asia Minor to procure camels has been fitted out under the direction of the commissioner of patents to proceed to South America for the purpose of procuring a fresh supply of cuttings of sugar cane for experiment in the Southern States. The United States Brig., *Release*, under the command of Captain Simms, sailed from the Brooklyn Navy Yard, a few months since, having on board the necessary number and materials for one thousand and eight boxes each about three feet in length in which to pack sugar cane cuttings. Mr. Townsen Glover has been designated to accompany this expedition."

Note: Mr. Glover was given full instructions where to go for cuttings and what kind of cutting should be taken and how they should be packed for the return voyage.

Further articles record that a temperature in the hold of the ship rose to 120 degrees and that all the cane was spoiled by the time that it reached New Orleans.

1872

Sugar Cane-
Need of New Sugar Cane in Louisiana

(21)

"An old and experienced planter of this state calls our attention to the degeneration of the ribbon cane, almost exclusively used by our planters, and affirms that much of the deficiency in the product of this staple is due to this cause. This degeneration he ascribes to bad cultivation and deficient labor and drainage, and to the necessity of the planters using inferior cane for planting. It is deemed of great importance that this degeneration should be arrested and to that end it is proposed to send to India for fresh and new plants so as to improve our stock, and restore the large production of former times.

The ribbon cane of late years has entirely changed its color, and its juice has lost its original aroma. It is no more the original cane imported to this state by Judge Borrin in 1810 as a curiosity. It was brought direct from Java to Charleston or Savannah with a cargo of coffee

and adapted itself so well to our climate, soil and cultivation that it rapidly superseded the old stock which had been long in use by the planters. The present degenerated Ribbon Cane is now more delicate and puny in its growth, more easily affected by frost, and subject to decay in windrow or mattresses, put up for seed. The stubbles will not keep sound after the first year, in fact the juice tastes like Sorghum, or corn stalk juice, and requires more boiling to make it granulate and yields double the molasses it used to do. In short, it is getting worthless.

Even higher cultivation and fertilizing have failed to restore the original vigor of this cane and bring back its bright stripes and its aromatic juice. The juice too makes far more molasses than sugar.

Many experiments have been made to introduce new canes into our State from South America and the West Indies, but they have generally failed. The Creole from Madeira, Ottalli from Cuba and Brazil, the Ribbon cane from Tehuantepec, Guasscale, Tampico and the Pacific Islands, none of these suit our climate. The rind of all of them is too thin, the eyes too small and weak and the roots not strong enough. Nothing has stood the test of our climate and soil so well as the Ribbon Cane from Java, which saved the sugar cultivation of this State after 1830.

Many years ago our government, at the suggestion of Mr. Lapice and Governor A. B. Roman, introduced through the Agricultural Bureau some canes from Penang, India. This was done at enormous expense, and a few of the eyes falling into the hands of Mr. Lapice, he cultivated it with great success for three years, but the first hard frost killed it. There was however, other canes in India of a superior quality, which mature early and it is believed that their introduction would be of vast benefit to our planters. It is proposed, therefore, by a combination of our planters to employ some experienced person to go to India, and after ascertaining the best stock in that country or in Java, or Sumatra to import a sufficiency thereof for the use of our planters. For this task we know of no person so competent as Mr. Lapice, whose propositions we take pleasure in laying before our readers and commend it to the favorable consideration of all who are interested in sugar culture.

It will be necessary for him to go by the Suez Canal, by Oriental mail steam ships of England or France, to go by Marseilles to Singapore and to return the same way to arrive here in time to plant the canes in December or January next, and to know how to pack them so as to keep them sound

and fresh. The passage, freight, and so forth will be very expensive, probably not less than five thousand dollars, which would be raised by fifty subscribers at \$100 each. He would ask one half of all the canes he succeeded in bringing here for his trouble and compensation, and divide the other half among the subscribers free of charge. It would be a most judicious expenditure for any sugar planter to make, to employ a competent and experienced sugar planter to make the selection; and not do as our Government did in sending a vessel to the West Indies, Brazil and South America to bring here worthless canes inflicted with borer."

New Orleans Times
The Sugar Cane, Vol. 4. pages 351-352
Published in 1872

1878 American Central Sugar Factories
 M. A. Montejo, C. E.

(22)

"The Louisiana planter may be said to have a general rule, a great deal of land, but to lack laborers. He has but little capital and still less credit to enable him to put this to good use."

1888 The Cultivation of Cane in Louisiana
 W. W. Pugh of Assumption

(23)

(Extract)- "It is a matter of grave doubt if we (on the Lafourche) are not in the habit of planting our cane too deep in the ground. In Ante-Bellum days, when the lands were new and of extra fertility, rattoons were often left for three and four years, and deep planting was necessary to avoid too great an elevation of the ridge before the crop was changed; now cane rarely yields more than two crops when the land is planted in corn and peas. Another reason in favor of shallow planting- there is likely to be more loose earth under the canes into which the roots can penetrate and find nourishment. I have heard that shallow planting is the general practise on the Teche, and the abundant yield of that section is a strong argument in behalf of the custom.

The plant cane having come up after a partial removal of the superincumbent earth, it is bared and freed from grass and weeds. A majority of cultivators add but little dirt until it begins to sucker, when dirt is gradually added; others add a little dirt at the first, working after it has come up, and continue to do so at each suc-

sive workings. The first contend with some show of reason that dirting before suckers appear has a tendency to keep them back; while others, admitting the fact say the suckers, though retarded in their appearance, yet more than make up for this by their greater vigor when they come through the ground.

Continued- Volume 1, No. 10, Page 111.

The rotation of crops and use of fertilizers may be appropriately discussed under one head, as both of them are intimately connected.

The cowpea is almost universally employed after two crops of cane have been taken from the field, and planted when the corn receives its final working.

The fertilizer most favorably known to planters, a knowledge of whose value dates back to the earliest period of agriculture, is composed of the excrement of animals, mixed with vegetable matter.

Before the war, when our fields recently brought into cultivation were too fertile in their virgin state to produce ripe canes, but little attention was given to fertilization. A crop of peas after cane was found to be ample for the production of the next crop. No doubt this was true for a limited number of crops, but at that time it was the general impression that our alluvial soil was inexhaustible, and would continue to enrichen the land owners to the end of time.

During the war poor cultivation (owing to the demoralized condition of labor) and the consequent failing off in the production of the soil suggested to thinking men that the general belief in the inexhaustability of our soil might be an erroneous idea, and that fertilizers would add greatly to the productiveness of both cane and corn.

The fact that cotton seed had been successfully used as a fertilizer in the cotton States for corn and cotton was generally known, and when the oil factories were established in the South the product of these mills in the form of cottonseed meal came gradually into great demand as a first-class fertilizer.

Continued- Volume 1, No. 11, Page 119.

If I were asked to give an opinion, as to the relative value of different fertilizers, I should give a vote in favor of cottonseed meal, not that I am convinced

that it is superior to all others, for this is a question now being tested on different plantations and at the experiment station. Some planters use cottonseed meal by itself, but most of them use it in connection with other fertilizers, and I think more of it is sold than any other brand.

I do not propose to discuss the merits of the different brands of fertilizer, for it is one of those questions on which planters differ widely, and which can only be definitely settled by experiments carefully made, but I propose saying something about the time and manner of their application.

When cane is planted, great benefit is derived from a simultaneous application of from 300 to 400 pounds of cottonseed meal. It warms the earth about the cane, and not only hastens germination, but causes suckers to make an earlier appearance and in increased numbers. These are decided advantages, and every day gained is so much added to the growing season, generally too short to enable cane to attain sufficient growth and maturity. The additional application of manure later in the season to plant cane is dependent on the fertility of the soil and the condition of the crop. If the land has had a good coat of vine turned under the previous fall, I think more meal would be prejudicial, as it would keep the cane in growing state too long, unless the fall season should happen to prove unusually favorable. After all there is a risk, and each planter must decide this question for himself, which is generally done, as I know some who add more fertilizer later in the season.

As to the time and manner of applying meal to cane, opinions differ. Some few drop it on the top of the ridge, after the cane is up and partially cover it with earth. Others, to whom I give the credit of acting with more judgment, apply it in furrows opened on the sides of the rattoons, and cover it with the plow. The last plan has one decided advantage as the ammonia contained in the fertilizer is protected from evaporation and is absorbed by the earth. Some planters apply the fertilizer when the rattoons are first barred; others later in the season when the roots make a start. I think that when it is early in the season, it should be followed by a larger application when the cane is barred for the last time, before it is layed by.

As to the number of pounds which should be used per arpent, opinions differ widely. On a sandy soil seven hundred pounds would not be much out of the way, but if the soil be black and stiff, you may add largely to

the quantity, some say 1,000 pounds, and are even more liberal in their supply. If the fields have been planted continuously in cane for years, you cannot fertilize too highly, more particularly if the land be of a stiff nature.

The benefit derived from fertilizers is largely dependent on the season. Moisture is absolutely necessary to decompose the manure of whatever description, and a long drought after it is spread nullifies its good qualities."

1888

BAYOU LAFOURCHE from 1840 to 1850- Its Inhabitants, Customs, Pursuits

W. W. Pugh

Vol. 1, No. 16, Page 179

(24)

(After 1835)

"Cultivation was carried on by means of the plow and hoe; the stubble was dug in the spring by the means of a narrow grubbing hoe, after being cut off by a weeding hoe. As long as the planters made money, but little disposition was evinced to quit the old ruts and devise labor saving implements to lighten field work. The inside of the sugar house underwent but little change for years, and it may be stated with truth that but little improvements were made until after the war, when stern necessity forced us to wake up and use our brain for the betterment of our purses.

In the introduction of sugar house machinery, progress has been rapid since 1865.

In field work the inventor has not been idle. It is truly said that necessity is the mother of invention, and with our demoralized laborers it was absolutely necessary that something be done to supply the absence of honest labor.

About this time, some changes were made in the width of the rows of cane and the manner of cultivation. The distance was increased from three and one-half feet to five and one-half to six feet, and two mule plows took the place of the single plows. Hitherto cocoa grass had been looked on as a great obstacle to the cultivation of the soil, and detracted largely from the value of a plantation when offered for sale. The use of a large plow speedily established the fact that the best way to overcome coco was to cover it with earth instead of shaving it off, and this plan is successfully practised at the present day.

Without this discovery the lands infested with this pest would be of little value, but now it affects cane and its growth but in a trifling degree.

We needed agricultural implements, which would transfer the labor heretofore performed by human beings to our muscular mules. This want has been supplied in part: we now use a stubble digger, which does its work effectively and neatly; a rotary hoe which to a certain extent takes the place of the darkey and his hoe; a road machine, which not only saves a great deal of work, but makes splendid roads for those who use the highway for hauling heavy loads or for pleasant rides; also Nardelph's pea vine rake for making hay, the plow of itself, nearly perfect and well adapted to the work required of it, has undergone little change.

Up to the year 1850 seed cane was laid down in mats; a slow process and often unsuccessful. To remedy this trouble the Rev. William Littlejohn of this parish (Assumption) tried the plan of windrowing the cane (generally two rows together) and covering it with a four horse plow. He was successful in his treatment, with seed cane as a rule laid in windrow. To secure its keeping there should be the least possible delay in protecting it from the heat of the sun.

(Abstract)- Mr. Pugh states that prior to 1832, the Creole cane was grown. After that date the ribbon and purple canes were grown. It is his opinion that the luxurious growth of the two named varieties as compared with Creole made it necessary to increase the width of the row in order to let in air and sunshine for ripening the canes. He also argues that the discovery that deeper plowing would control coco grass added to the necessity for increasing the width of row in order that two mule plows could be used.

1889 Experiments in Shaving Cane and the Machine
Used- James Mallon, (26)

"In 1871, I used the Allen shaver with revolving blades; this required four mules and two men to work it.

I made experiments in 1871-2-3 shaving ten rows and leaving ten for several cuts. That which was

shaved gave the best stand.

In 1873 I got up a shaver with slide frames and two knives which could be raised or lowered without stopping. Two mules could operate it very well but the sliding cut ground off the edge very fast, and required grinding or filing every two hours, or it would split the stubble. I have now got a shaver of the best mechanical construction for light draught and lasting that I know of, run on four wheels and has revolving knives.

1889

Discussion of Stubble Shaving-

The Louisiana Sugar Planters Association, 1889.

The Louisiana Planters and Sugar Manufacturing
Vol. 2, No. 9, Page 101. (27)

Captain Pharr- "You are making experiments. You have not seen stubble where the two bottom eyes had sprouted first? In February cane has got no strength and if you have a cold wet winter those bottom eyes will die. You can never get the rest of the eyes to amount to anything, Sir."

Dr. Stubbs- "I have never tried that, Sir: Can't we get the other eyes on the cane?"

Mr. Pharr- "No, Sir. The bottom eyes first, and they are always the eyes to come first, and when those eyes die out from the cold, wet winter, the balance of your eyes never amount to a row of pins."

1890

The Progress of Sugar Culture and Manufacture
Judge Emile Rost (28)

Mr. President and Gentlemen of the State Agricultural Society: "The subject which I have been requested to discuss before you, presents so many questions, that in order to be brief, I would simply give you a general view of what has been done in the sugar business, especially during the past twenty-five years. The cultivation of sugar cane has existed in Louisiana for more than a century. Martin, in his history, states that the manufacture of sugar was commenced in 1764, that it was abandoned two years later, and was again resumed with success in 1794. Only horse power mills were used until 1825; the introduction of steam mills gave the first great impetus to the business, for in less than twenty years after the crop of the State had reached

450,000 hogshead, or nearly 250,000 tons, being at that time nearly one-half of the consumption of the entire country. In 1888 sugar was manufactured in twenty-three of the parishes of the State, there were in operation 776 sugar houses of which 91 only were worked by horse power; of the total number, 147 were provided with vacuum pans. We find that these sugar houses produce more than half the entire crop, the production of the larger houses having increased every year, while that of the smaller houses diminished. When after the close of the war, the sugar planters, encouraged by the high price of sugar, undertook to rebuild their industry, the business from 460,000 in 1861 had fallen in 1865 to 150,000 hogshead. Most of the sugar lands had been abandoned, the levees had been neglected, overflows were almost periodical, and a new system of labor had to be organized and adapted to the requirements of the cane crop. It took many years to overcome these difficulties, but in 1886 the crop obtained from 130,000 acres of cane, ground, throughout the state, produced 285,000 hogshead of sugar. I venture the assertion that the number of acres in 1887 does not represent one-half the amount of land cultivated in cane in 1861. Bouchereau, in his report for 1887, claimed that planters using modern machinery, obtained an average of 2,929 pounds per acre, or 128 pounds per ton of cane ground. While those using other appliances obtained 2,510 pounds, or 103 pounds per ton of cane. Under the old slave system, when the planter had a plentiful supply of labor, and held it under control, the cane crop was, so to speak, a hoe crop, the cleaning and the weeding, and the covering and the digging were all done with the hoe; with lands well drained and with thorough cultivation, the sugar crop increased rapidly up to 1861, although up to that time the manufacture had made little progress. This was all changed in 1865, and the first problem to be solved was how to replace by labor saving machinery the old hand labor which was leaving the cane field and was becoming every day more scant and more unreliable. To this necessity we owe the introduction of various implements of immense value; such as the cane rollers, which press the dirt on the planted cane, when covered with the plow, the cane shavers, which clean from the stubble the dead wood and the winter grass, the stubble digger which with its iron fingers, revolves along the row, and turns and loosens the soil about the stubble cane so that there is nothing left to do but pull the dirt away, and finally that most useful of all implements, the horse hoe or cane cultivator (Disc cultivator), which covers or uncovers the cane, adds dirt or takes it away, according to the requirements of the crop. With these improved implements, nearly one-half of the former hand labor required is done away with, but as the price of sugar kept going down, the planter found he must increase his yield per acre in order to hold his own, and this necessity brought about another great step forward, the general use of fertilizer. Twenty years ago, many planters objected to the use of cottonseed meal as a fertilizer for cane, claiming

that it stimulated vegetation, and destroyed the sugar, and at that time commercial fertilizers were used on but few plantations; today a large trade exists both in cottonseed meal and other fertilizers, thousands of tons are applied every year and with such good results that the demand for fertilizers increases steadily. On some of the largest sugar places the item of fertilizer represents every year an outlay of thousands of dollars and yet this heavy expense is found to be profitable, as it has raised the average production per acre to nearly double what it was thirty years ago. Within the last five years, two new factors have appeared in support of the Louisiana sugar industry: First, the establishment at Kenner by voluntary subscription of a sugar experiment station, and the selection as Director of that station Professor W. C. Stubbs.

The second great factor was the establishment by the Department of Agriculture at Washington, of a diffusion plant at Magnolia Plantation.

1892 **Experiments in Cultivation, Stubble Shaving, Etc.**
 at the Sugar Experiment Station
 W. C. Stubbs

(29)

Mr. Jas. Mallon, the inventor of many implements used by the sugar planter of Louisiana, claims to have a cheap and effective method of cultivating the cane crop. He uses two cultivators only. One is familiar to all as Mallon's Rotary Hoe or disc cultivator; the other is a walking cultivator with five small plows attached. These plows can be removed or adjusted at pleasure. He breaks the middle with the latter and pulls up the dirt to the cane with the former. At lay-by he uses the large disc on his riding cultivator, followed by his walking cultivator with only three plows on. He has given his method to the public press. In 1890 we have duplicated plats in foreign varieties, one arranged to be irrigated, if necessary, and the other not. They were to be otherwise treated alike. On account of the favorable seasons both received the same treatment. In the winter of 1891 one plat was tilled. These plats were continued into stubble in 1891. The tilled plat was turned over to Mr. Mallon according to his directions. The untilled plat was cultivated by the usual method of the station. Mr. Mallon shaved his piece as a part of his process, while the other piece remained unshaved. They were fertilized alike. The following are the details of each cultivation:

Note: These two methods of cultivation consisted in a substitution of Mallon's cultivators for the plow and some form of a middle cultivator. Stubbs did use Mallon's Disc Cultivator for a part of his work.

Mallon's plats out-yielded Stubbs' by 2.29 tons. Stubbs says: "Mr. Mallon's system of cultivation is rapid and economical. He claims to be able to cultivate fifty acres of cane with one pair of mules. The cane was certainly not injured by his system. His method has much to recommend itself to the planters."

1892 The Composition of Sugar Cane at Various Stages of Growth- Unsigned but must have been written by W. C. Stubbs. (30)

This article describes a set of experiments on the above subject. The conclusions are as follows:

"That the mother cane supplies the young sprouts with albuminoids, fat carbohydrates and (perhaps) ash in the earliest stage of its growth and then arrives a time, perhaps as soon as the root system of the young plant is well developed, when these sprouts cease to draw on the mother cane for nourishment, and the latter remains thereafter nearly constant, except from decay.

That the composition of the cane plant varies greatly during growth. While young the percentage of ash, albuminoids and fat are the greatest, decreasing until, at maturity, they become "minima". The fibre and carbohydrates are small in the young plant, increasing with growth and reaching maxima at maturity."

1892 Cultivators (31)

"The excitement on the Armand and St. James Plantations is now all about double cultivators. Uncle Ben (yclept) Mr. J. K. Tucker, has become converted to them, and I believe he told me that he thinks they will bring about a saving of one-third the teams and men whenever they are built a little heavy and a little wider. Mr. Piper, tenant, on the St. James, bought the first one, and Mr. Beckner, tenant, on the Armand, bought the second one, and to say they are enthusiastic about them, is putting it mild.

According to the writer's opinion, the walking and riding double cultivator will take the place of the single cultivators, the one and two horse plows, and of the disc cultivators, of which later the Ladow, Mallon and Hall seem to be the leading favorites here. As all the factories which make the latter also make the former, the change need not embarrass any of the manufacturers or dealers. As far as the single cul-

tivators and plows are concerned, the double cultivators are so far ahead of them that they cannot be named together in the same breath; and the writer is not afraid to repeat the assertion he made in these pages last year, that it would be impossible to give one away to a western farmer, for he would not take it as a present. It would be interesting to know how much money the Louisiana planters have lost in the last twenty years, at which time (and before) the Illinois and Iowa farmers made the change, by not changing at the same time. In a cultivating season of ninety days, a man will save \$90 in wages on each double cultivator which is the interest on \$1,500 at 6 per cent, or on six cultivators, \$9,000; or, in other words, a plantation on which a dozen single cultivators have been used ought to be worth \$9,000 more by using the double cultivators, less the difference in the price between each two single cultivator and a double cultivator, say, \$10 each set."

1893 Sugar Cultivation in Louisiana
By- Miss Kate Minor

(32)

Abstracts from a lecture by Miss Minor at Congress on Agriculture, held in Chicago.

"One man can produce, with improved farm implements, 10 percent more cane in 1892 than he did in 1860. In 1860 the average per acre of sugar produced was 1,500 pounds. In 1893 very nearly 3,000 pounds was the average - and let me here state that the most favorable circumstances produce 7,000 pounds. Showing that in the very near future the average will still be increased. 6,000 pounds per acre was not an uncommon result for plant cane in 1892. I give this as my personal experience, that several hundred acres on our Southdown Plantation yielded an average of 5,000 pounds to the acre."

In 1860 an acre of ground yielded from 10 to 15 tons, now it often yields from forty to fifty tons.---- All of this increase is the result of new methods and of most careful study and experiment, which has cost the planter many thousand dollars. One hundred million of dollars are invested in sugar machinery in Louisiana. The bounty has stimulated the expenditure of money in this direction.

In no part of the United States is cultivation more absolutely perfect than on a sugar plantation. The plantations are worked with a large degree of neatness that would suggest the kitchen garden. The land is ploughed and prepared in the fall of the year, and broken up deeply with a four mule plow. It is then laid down in rows four feet apart, the bed

being carefully arranged for the reception of the stalks of cane, which is laid down in this way; two stalks and a lap being allowed as the proper quantity of sugar cane to be used as seed. It must be remembered that this seed is exceedingly expensive, as one acre of cane under the most favorable circumstances will only plant from five to six acres. Therefore, much of the crop must be saved for the seed of the ensuing year. The cane is covered with twelve inches of dirt, which is a sufficient quantity to prevent the frost from descending into the ground. The cane can be planted from October any time during the winter months until the middle of March, when the dirt is carefully removed by degrees and cultivation for the ensuing year begins.

Mules are entirely employed on the plantations, and give most satisfactory results, having great powers of endurance and standing the Southern climate much better than horses, so that the plowing and work on the plantation is done with them. They are especially suited to the negroes - they seem to have a mutual understanding. The mule is an intelligent animal, and while he is nothing like as fast as a horse, he will not submit to having himself overworked. He grows stubborn when he thinks that he has performed a sufficient amount of labor, and no amount of urging seems to make the slightest impression upon him. He is exceedingly docile, with the exception of sometimes being a little careless with his hind feet.

The cultivation continues until July, when the crop is said to be laid by. The middle furrows are plowed out very deep, and a good ridge is left to the cane to nourish it during the rest of the growing season. These deep furrows between the rows help to keep it well drained and convey the water to the cross furrows which take it to the half acre ditches, these ditches conveying it to the large canals on the lower part of the plantation, where it runs into bayous, swamps, and so forth.

For a long time but one little stalk appears, which grows a little yellow, and during the month of May does not seem to grow at all. This is known as the suckering period, and the original stalk will often have around it twenty-five or thirty suckers. But all these suckers in a short time catch up with the original stalk, and when the harvest season arrives there is no difference in the size of them.

The stubble cane is treated slightly different from the plant cane. It has now been found that by shaving off the old stalks early in April, and then digging out the stubble by machinery very much better results are obtained than with the old modes of cultivation. This is done to expose the eyes to the sun, which causes them to germinate more rapidly.

One third of the plantation is planted in corn and cow peas, the latter are used to renew the soil just as buck wheat is used in many of the Northern states, but by having the pea vine racked and preserved as hay one of the finest materials of provender known is thus produced. And not only does the pea vine supply the hay of the plantation, but it performs the double service of improving the condition of the ground. In many instances the pea vines in August are plowed under, this, of course, is more desirable; but even without this, great good has been rendered the ground, simply by the pea vine shading it, and the roots which run down very deep bringing up to the top the nourishing qualities of the soil especially suited to the wants of the crop of cane in the year following."

1893 Report of the Operations of the Palo Alto Belle Terre and Peytavin Sugar Houses for the Season of 1892.

With a General Summary of Palo Alto Field Results
Clinton Townsend (33)

Nitrogen

No. 1 In 1891 nitrogen on sandy land plant cane was charged with a loss of \$10.05 per acre. This year \$10.02 loss is found.

No. 2 Nitrogen on stiff land plant lost \$4.28 in 1891 and \$13.82 in 1892.

No. 3 No absolute figures were given last year, but a loss for the use of nitrogen was surmised. This season a loss on sandy land stubble of \$15.57 per acre occurred, and a gain of fifty three cents per acre on stiff land.

No. 4 The succession plant cane was uniformly fertilized with cottonseed at planting; consequently no data of gain or loss are at hand. On certain plats, however, the second fertilization was omitted and a gain of \$5.90 resulted from the omission.

Phosphoric Acid

No. 1 Sandy land plant cane gave an increased yield (average of two plats) equivalent to nineteen dollars and thirty five cents per acre.

No. 2 Succession plant cane which had been previously fertilized (at planting) with cottonseed meal gave a net gain of \$8.75 per acre.

No. 3 Upon stiff land plant cane, a loss of \$3.75 per acre occurred.

No. 4 Upon sandy land stubble a loss of \$4.75 followed its use. No trial was made upon stiff land stubble, a large amount of commercial fertilizer containing a very little water-soluble phosphoric acid, but a considerable amount in a reverted form was used, but failed to show the benefits which followed the use of water soluble acid.

Mixtures of Nitrogen and Phosphoric Acid

From the foregoing it will be seen that upon stiff land plant and sandy land stubble both nitrogen and phosphoric acid failed to give better net results. Upon both these classes of soil, as well as upon the others, two mixtures were tried, which for convenience we will call No. 4 and No. 5.

Upon stiff lands plant cane both mixtures were successfully giving as net gains per acre \$5.60 and \$6.25 respectively. Sandy land stubble both nitrogen and phosphoric acid failed apparently from opposite causes. Nitrogen gave a large increased tonnage, but its effect upon the juice was little short of disastrous. Phosphoric acid, on the other hand, seemed to have little or not stimulating effect upon the tonnage, and no appreciable effect upon the sucrose. The more successful mixture in this case was No. 5, from the use of which a gain of \$8.95 per acre followed.

Composition of Mixtures

	No. 4	No. 5
Nitrogen	7.45	3.28
Equal to ammonia	9.04	3.98
Water-Sol P. 205	9.49	12.53

Note: Plant cane check plats yielded about 33.0 tons: Stubble cane check plats yielded, 19 to 22 tons.

1893 Field Experiments with Sugar cane at Calumet Daniel Thompson and Hubert Edson

(34)

"Mr. Edson brings out strongly the serious injury that our cane crop suffers by the wasted energy required in the development of a large number of suckers and their subsequent destruction by over crowding, or by whatever causes induce it. Its an old problem in our industry to determine whether to plant

for a stand, or to plant more thinly and to depend upon suckering for a full stand. If as has seemed to be proven by experiments at the sugar experiment station, suckering is a natural function of the plant, and if retarded or suppressed, interferes with its maturity, then thin planting and increased suckering would seem to be the best method of obtaining a stand, and quite a number of planters of large experience believe this is the best way.

Mr. Edson has been investigating the relative value of stubble and of plant cane for seed, but apparently without having arrived at a conclusion satisfactory to himself, and he believes that further experiments in that direction will be necessary. Years of experience in this state has substantiated the great value of plant cane as seed, all the incidental conditions being satisfactory. If these conditions are satisfactory, the resulting crop from plant cane seed and stubble will show the crop from the plant to be considerably more advanced during the entire cultivating season, and as probably giving a heavier tonnage. It would require further investigation to determine the main results by considering the sucrose content of the cane. Plant cane is rarely used for seed, owing to the fact that such use ordinarily destroys the stubble from which the cane is taken, and further to the fact that the larger amount of moisture in such canes seem to reduce their capacity for resisting the ordinary conditions under which seed cane is held in windrow or in mats for several years.

Mr. Edson has made a special study of seed cane selection, and in this we think has accomplished the most brilliant results in his field experiments. His plan having been to select the richest canes and the poorest canes of any given kind, to see if it were possible to perpetuate these distinctive qualities. He first sought a method of analyses, by means of which he could more readily determine which canes were the richest and which were the poorest. For this purpose the canes were split in two, longitudinally, and one of the halves thus obtained analyzed, and it was found that the third quarter from the bottom of the other half gave a similar analysis, and hence that the third quarter from the bottom of any cane would ordinarily give the analyses of the whole. In the ordinary analyses of seed selection, the total solids were determined by the brix spindle.

Mr. Edson calculates with seeming accuracy that improvement thus obtained would give seven and two tenths pounds of sugar per ton as an increase from planting rich cane instead of the average cane, and that this, for a factory grinding 450 tons of cane per day, would add 2,280 pounds of sugar to the days output, and on a crop of 25,000 tons give 18,000 additional pounds of sugar, worth say, \$9,000, or the value of 2,000 tons of cane."

1893 Essential Conditions in Laying-by Sugar Cane
T. P. Hutchinson

(35)

Gentlemen- "Before cane is laid-by, it should be sufficiently advanced in growth to keep down farther development of foul growth, such as grass and weeds. If the rows are of the proper width, say from five to six feet, the cane may be considered to have reached this stage of growth, when the plants are from three to four feet high. A thorough cultivation at this stage will remove any foul growth that may be present, and the rapid root development that the cane is now making, together with the shade that is being formed, will prevent other plants from growing. All cultivation of cane should be of the surface type. When the soil has been once thoroughly prepared and the cane has been well "off-barred", there is no farther necessity of deep ploughing.

In my opinion the best implements not only for "laying-by" cane, but for the entire cultivation, are those devised by Mr. James Mallon of New Orleans. They are Mallon's Section Disc Cultivator, and Mallon's diamond turn shovel or (walking) cultivator.

By the use of turn plows and double mold board advanced plows in cultivation, not only are the roots of the cane seriously cut, and destroyed, but in stiff lands the soil is turned up in large clods that may become hardened by a few days sun and remain in an unpulverized condition several days or even weeks. This condition of soil is very unfavorable for root development, the roots that have been injured cannot overcome the shock that has been given them, and, as a consequence, the cane suffers. Of course, good rains that serve to disintegrate the clods and bring the soil into pulverized condition will remedy the evil, but will not overcome it entirely; for when once the roots of the plants are injured, the plants are bound to suffer more or less.

Another objection to the double mould board advanced plow is that it leaves the bottom of the furrow almost entirely bare of loose soil. This is not so objectionable if the lands have not been thoroughly drained, but when land is well drained, it is not only unnecessary, but often injurious. The smooth bare conditions of the bottom of the furrow leaves the pores of the soil directly exposed to the rays of the sun, and if dry weather should follow the cultivation, this portion of the surface of the ground soon becomes dry and hard and impervious to the young and tender rootlets. I have often noticed enormous cracks formed in the earth in the track of this double mold board advanced plow. The amount of soil thus rendered unfit for root development is greater than one would first suppose.

and constitutes from six to ten per cent of the entire surface of the field.

1893 The Essential Condition in Laying-By Sugar Cane
T. Mann Cage

(36)

(Abstract)

Here the culture must be such as to as far as possible promote rapid growth, and early partial maturity - process never attaining a high point of excellence owing to the shortness of the season.

What is aimed at in the early and thorough cultivation of the field, their drainage and proper fertilization, is to place the soil in the best mechanical and other conditions possible prior to the time when the canes will receive the laying-by working. Years ago the planter laid-by his crops on four furrows, meaning that he did not intend to disturb that portion of the soil again with the plow, the canes being hilled with the hoe later on, after which the middles were plowed out. Now that machines have almost entirely superseded the hoe, the trend of opinion is toward working to a water furrow, which lessens the risk of injury from either wet or dry weather.

Canes at intervals of a number of years are somewhat dwarfed by dry weather, and when the time arrives when they should be laid-by, they are seemingly too small and the land too cloudy; but it being infinitely better to lay-by in the dust than in the mud, prudence would prompt the work be done - even when the possibility of it having to be repeated later to destroy weeds and grass.

Theoretically, the land should all be made manurially rich and kept in a state of fine division by frequent cultivation. The cane should be so treated that the suckers will appear early at the base of the shoots, from either plant or stubble, and the roots develop at an early date, when the suckers have appeared and the roots attained the length of one or two inches then the cane should receive the lay-by working, if large enough. In practice just when the more advanced fields have such conditions when they would be laid-by, frequent rains preclude the possibility of performing the work just at the proper time, consequently, the planter may find that when that land has become dry enough to plow, the major portion of the crop may require his attention, and he necessarily devotes his time to the field where the canes are the most thrifty.

It being the generally accepted opinion to root prime cane growing on rich lands tends to augment the tonnage at the sacrifice of sugar, such canes are laid-by early and if sparch vegetation does appear between the rows, it is left undisturbed by the plow, rather than to work it late. When the canes are somewhat small and do not promise to somewhat shade the ground and the soil not very fertile, cutting the roots which

first appear does not seemingly injure the cane, and the after root development is more profuse in the freshly plowed earth, if sufficiently moist to induce extension. The planter may virtually lay by a portion of his crop in May, by banking the earth to the cane, and immediately afterwards plow out the middles.

If the soil is not compacted by heavy rains later on, when a young coating of extraneous vegetation appears, he may without disturbing the soil in which the roots have partially penetrated, hill the canes with a laying-by machine, after which the middles can be plowed to the desired depth. The latter would be the time when the canes are practically laid-by, although the important factor of not disturbing the early developed roots had been accomplished through the instrumentality of the early working."

1893 The Essential Conditions of Laying-by Sugar Cane in Louisiana- John Dymond (37)

(Abstract)

"We are lead, then, to consider the conditions that permitted laying by early in former days, when enormous yields of sugar were frequently procured with very primitive apparatus, and those which prevail now when we are prevented from laying by until late, and when large yields of sugar are only obtained by the use of the finest and most expensive machinery and the exercise of the highest skill in our cane culture and sugar manufacture.

Mr. Edmond Fortier of the Parish of St. Charles in the year 1819 made 320 hogshead of sugar from 97 arpents, or its equivalent, 81 acres of plant cane, or say four hogshead per acre. In 1828 this same gentleman, from 266 arpents of cane, or its equivalent, 222 acres, made 700 hogshead of sugar. These records of the early days of our sugar industry rather puts to shame our modern so called successes, and makes us wonder if cane culture is not a lost art with us, although our sugar manufacture may be highly developed.

In the early history of cane culture, the cane rows were far closer than now. Large cane crops were produced in Louisiana with the cane rows four or five feet apart. As the production of sugar cane in Louisiana increased, there was a general effort made for better work, and this was thought to lie in the general direction of more plowing, and in order to facilitate plowing, two horse or two mule work was adopted instead of one horse, necessitating greater distance between the rows, and finally with the adoption of four mule work, and especially in stiff lands, the common standard of seven feet between the rows was

adopted with advocates of even greater distance. With cane rows seven feet apart, it was still found possible to throw up a high ridge and to plow out a deep water furrow by the first of May, but an adequate stand was rarely ever had by that time, and modern seven foot cane fields, if laid by on the first of May, would soon become grassy and give inferior results, and hence laying by became more and more delayed until July the first has been reached as the standard date, at which time the great heat becomes injurious to the work animals, and the cane is ordinarily of sufficient height to shade the ground and prevent the subsequent growth of weeds.

We seem to find two causes existing and preventing the success of the early laying by that was customary a generation or two ago, viz., the greater closeness of cane rows, then, which promoted the early shading of the land and the prevention of the growth of weeds and grass in the middles, and the reduced fertility of our lands, reducing the luxuriance of the growth and necessitating later cultivation in order to extirpate grass, and in order to promote the development of the cane plant until they adequately shade the middles.

We seem thus to have another essential condition in laying by, which is that the cane shall be large enough to shade the middles sufficiently to prevent the growth therein of weeds and grass. Very deep final plowing is at times resorted to in order to effect this, and turning up of the raw sub-soil being sufficient to prevent the growth of grass until the cane reaches such height as to adequately shade the middles.

1894 Field Experiments with Sugar Cane at Calumet
 The Sugar Cane, Vol. 26, Page 271

(38)

"We are informed, however, that the experiments in Louisiana show that it is precisely the healthiest and most vigorous canes that in the long run, are found to contain the greatest percentage of sugar in the juice, and that the conclusions that the richest canes, which in Louisiana are almost invariably the largest, yield the heaviest tonnage is warranted, up to now, by the results of five experiments, against only one to the contrary. The question here appears to turn on the way in which the large tonnage per acre is looked at. If large tonnage is gained by an increase in the number of canes produced, the saccharine will be low, but if by increase in the size and weight of the individual canes the saccharine content is, testes the experiment at Calumet increased."

Note- Dr. Kobus, of Java, disagrees with Edson.

1895 Composite Factors in Cane Culture
Thos. Mann Cage

(39)

"The stubble digger and the shaver can be so modified as to perform the work required without barring the rattoons, and spring planting can be scraped without the cane being barred. At one time it was deemed indispensable to hand-dig stubble and in laying by the cane crop, plant and rattoons, cross hauling the earth to the plant was not only very expensive, but hard and slow work, until almost entirely superseded by the disk laying by machine which came into vogue. Then came the double mould board plow for two or four mules- an implement which has proved of marked utility in the past."

1896 The Cultivation and Preservation of Canes Destined for Seed- Thos. Mann Cage

(40)

In this article, Mr. Cage points out that the number of eyes on a stalk of cane are determined by the length of the growing period and not by the length of the stalk. By comparison he found that two stalks grown on the same row for the same length of time, but one of them fertilized to grow six feet and the other not fertilized at all and growing but four feet, showed by count the same number of eyes. From this observation, he points out the economy in the theory of omission, to grow short cane for planting purposes at a minimum cost and to plant according to the number of eyes.

1895 Progress of the Sugar Industry in 1895
(Communicated to the Chemiker Zeitung,
by F. C. Thiele)-

(41)

"The last season has turned out on the whole more favorably than it seemed likely in the beginning. This is principally due to the disturbance in Cuba, which nearly the entire sugar crop of the island has been ruined. The Louisiana crop has, however, fallen considerably short of the previous year, owing partly to bad weather during the summer months and partly to a reduction in area under cultivation. One circumstance has been more prominently brought forward by this reduction, viz., the defective, and to some extent incomprehensible manuring of the fields. As I have already remarked in a former article, there appears to exist in Louisiana, up to now, no faith whatever in scientific investigation and experience, in most cases there is distrust of them and this especially applies also to the results obtained by well directed manuring in other countries. For the most part the planters here follow the same methods which were used by the monks who first brought the sugar cane hither from Cuba. The cane is planted partly in the Autumn and partly

in the early part of the year (end of January) and a certain portion springs afresh from the socalled stubble. In March cottonseed meal is scattered over the field and ploughed in, and then the material part of the cultivation is ended. Year after year the same manuring is applied, without any investigation being made as to whether such a constant supply of nitrogenous matter really benefits the cane. On examining the ash of the sugar cane they have been found to contain a considerable quantity of phosphorus and also salts of lime, while the nitrogen content in the cane is only very moderate. This should certainly call the attention of the planters to the fact that other things than cottonseed meal are required to secure a good harvest. Some modest attempts have been made to supersede the old system by methods based on scientific observations. Last year trials were made in this direction on "South Side" plantation; and on examination it was found that all the cane manured with phosphates showed a higher saccharine content, and also gave a higher yield per acre."

1898 The Sugar Cane Vol. 30, Page 205

(42)

At the recent annual meeting of the Louisiana Sugar Planters Association, Dr. Stubbs said that he estimated that \$2,000,000 was annually lost by Louisiana Sugar planters using too much seed cane. It was better and cheaper to plant carefully, and use from one to two stalks.

1897 Preparation and Cultivation of Our Sugar Lands
W. C. Stubbs

(43)

Yield of plow culture Vs cultivator. Average of three years

	Cultivator	Plows
Yield in Tons per acre	39.27	30.74
Analysis		
Brix	13.94	14.63
Sucrose	10.5	11.45
Purity	76.50	78.25
Pounds of sugar per acre at 75% Ext.	5,077	4,449

1899 Best Methods of Planting, Fertilizing and Cultivating
Cane So as to Give Best Results in Sugar-
R. G. Comeaux (44)

"The old method, and one still largely in vogue, that of deep plowing in cane late in July, or until the mules are hid by the cane tops will have to cease.

The season in Louisiana is too short for cane to mature and as its age dates from the day it is laid by to the day it is cut, then it is evident that cane laid by the middle of July, and cut in October for the mill, would be very immature, unless the fall months are either very dry or the land was sooo poor as to cease nourishing the cane along in September.

For the reason last given, cane in old worn out lands produces plenty of sugar, but as that kind of cane always results in low tonnage, does it pay? Is there no means by which we can combine the two, heavy tonnage and good sugar yield? I believe that if ever the chemist is to help the sugar planter, he will start right here; he will analyze our soil, and tell us in what properties it is deficient.

It is useless to believe that we can dispense with the use of commercial fertilizers in the growing of sugar cane. still many contend that fertilizer produces green cane.

The first requisite to grow cane successfully, is to have good drainage; the second, in my opinion is fertilizers, judiciously applied. In all styles of business, we have systems; have methods expressed and well defined on paper, which are guides to run the business, and we have recourse to them from time to time, as the occasion requires; until we have learned to make a success of our business, but in my long experience in raising sugar cane, I have not yet seen a method or treatise on cane growing, a method by which a beginner could start in the business, and by giving proper care and attention, be guided, safely to success.

It has always been the custom to leave cane on the barr furrow until it was up to a stand, and even longer, that the sun might heat the roots. That, I believe, is an error. Cane should as early in the spring as is considered safe from the cold, be barred off and scraped very close, but it should remain in that bare condition only a few days, when a light furrow should be brought up on each side to retain moisture; from thence cultivators with narrow shovels can be worked frequently to great advantage.

It is just at this stage that commercial fertilizers cut a most important figure. Eight years ago I began to

use fertilizers. The first year I used eight tons; since that time I have increased the amount gradually every year, until last season I used 104 tons. I have not yet reached the limit and still consider it safe to use more.

1899 The Best Method of Planting, Fertilizing and Cultivating Cane so as to Give the Best Results in Sugar
W. C. Stubbs- (45)

Table No. 1

Kind of Cultivation	Tons Per Acre	Brix	Suc.
1. Double horse plow	36.78	15.46	12.48
2. Two horse plow and disc cultivator	39.51	15.12	12.36
3. Two horse plow and disc and middle cultivator	42.56	15.40	12.89
4. Disc cultivator and disc middle plow	38.37	15.01	12.68

Table No. 2

1. Two horse plow	26.10	13.21	9.65
2. Two horse plow and disc cultivator	31.05	13.23	9.65
3. Two horse plow and disc middle cultivator	31.16	13.68	10.27
4. Disc cultivator and disc middle plow	31.24	13.42	9.80
5. Disc and middle cultivator	33.35	13.24	9.86

Four years ago comparative experiments with different methods of cultivation were begun. The first two years only two methods were adopted. First, with two horse plow only, all through the season; second, after the middles were returned to the cane by the two horse plow, the disc and middle cultivator only were used. Through two years of plant and stubble, the latter method gave an average of over ten tons of cane and 700 pounds of sugar per acre each year over the former.

Two years ago a large plat was laid out for cultivation experiments, five systems were adopted, first, double horse plow, it was used alone in all the operations of cultivation. Second, the disc cultivator was used to cultivate the upper portion of the rows, while the middles were split out by the two horse plow. Third, the two horse plow was used to return the furrows to the cane after a stand was secured and all subsequent cultivation performed by the disc cultivator, and the middle cultivator. Fourth, the furrows were returned to the cane by double board plow, and in all the subsequent operations, the disc cultivator followed by double mould plow were used. Five, the furrows returned to the cane by the middle cultivator and all subsequent cultivation made with disc and middle cultivators.

These methods were triplicated in the plat and so arranged as to preclude any possibility of variation in the soil. There were fifteen subplats, of from three to six rows each. To avoid any error which variation in rows in different plats might occasion, every row was separately counted, weighed, and the juices carefully analyzed. The average of each method is given for each year. Table No. 1 is plant cane for 1897. Table No. 2 is first year stubble of 1898. The plat is the sandiest on the station, and was in excellent tilth both years.

The season of 1897 was almost an ideal one, giving us a large tonnage with fair sugar content. The season of 1898 was execrable in every respect, and cultivation experiments were not as clearly differentiated on account of excessive rains prevailing throughout the last half of the season. Yet both years were pronounced against cultivation with two horse plows - 5.78 tons in 1897 and 7.25 tons in 1898.

The use of disc cultivators with either two horse plow or double mould board plow is a great improvement over two horse plows alone, but inferior to disc and middle cultivators.

In 1890 the station was removed from Kenner to its present abode. There were selected three plats of about one acre each, of apparently uniform fertility, for replies to above question for each ingredient. These plats each divided into twenty subplats. No. 1 was dedicated to nitrogen, as manures, No. 2 to phosphoric manures, and No. 3 to Potassic manures.

Also at regular intervals a plat was left without fertilizers of any character to test the natural need of the soil.

Since 1890 these plats have received each year the same fertilizer and will be continued indefinitely.

The average of eight years upon these soils have shown that nitrogen is the dominant ingredient in all fertilizers for cane, and that phosphoric acid in moderate quantities is also required. Potash has not been found at all beneficial. While sulphate of Ammonia has shown each year a slight superiority over the other forms of nitrogen. Its high price gives no financial benefit to the planter. Cottonseed meal comes next, followed closely by dried blood, nitrate of soda, Tankage, and fishscrap, in the order named. All should be combined with available phosphates.

Of the various forms of phosphates used, the soluble gave the decidedly best results, followed by slag meal, floats, bone black and ground bones.

A combination, therefore, of nitrogen and phosphoric acid in available forms is best adapted to sugar cane.

The next questions arise, how we shall combine them; how much of each shall we use per acre; how deep shall they be applied; and how they shall be distributed in the soil?

It has been found also that but few of our seasons give us rainfall in quantity and distribution sufficient to enable the cane to appropriate 48 pounds of nitrogen. Hence, a large quantity is excessive, and it may be a waste. It is, therefore, safe to recommend quantities of nitrogen varying between twenty-four and forty-eight pounds per acre for our cane crop. Again, different soils and different kinds of cane require varying quantities of nitrogen. Plant cane upon pea vine land will not require the same amount as upon succession lands, that is upon soils from which a crop of stubble cane has just been taken, and which has been continuously in cane for years without the intervention of a leguminous crop to restore nitrogen. Indeed, such soils are frequently in an execrable physical condition, which not only precludes the possibility of themselves furnishing plant food, but also prevents them from assimilating much of that presented in the form of commercial fertilizer. Hence, the unsatisfactory results from manuring succession canes, so often experienced by planters. It is doubtful whether one half the plant food applied to succession canes in commercial fertilizers is recovered in the cane in the average season.

Pea vine lands put in plant cane, on account of their excellent physical condition, not only yield up readily the nitrogen stored up by the peas, but can also assimilate large quantities of plant food supplied as fertilizers. Hence, such canes usually make large crops.

Since nitrogen is the chief ingredient taken from the soil in our crop of cane, it follows that with each successive crop of cane grown on the land, without the intervention of a restorative leguminous crop, there arises an increased demand for nitrogen. Hence, stubble canes require larger quantities than plant cane, and the older the stubble the larger its requirements for this element to make a given tonnage.

From investigation made by this station, a crop of cow peas, turned under at the proper time will add at least 100 pounds of nitrogen per acre most of which is believed is gathered from the air. The average crop of plant cane grown upon pea vine land is not far from 30 tons per acre. The first year stubble following this plant should give twenty tons per acre, and if kept for the second year stubble, a crop of at least fifteen tons per acre should be obtained. The three years cropping would give 65 tons of cane, which together with the tops and fodder which are burned, would remove from the soil 221 pounds of nitrogen. Of this amount 100 pounds would be furnished by the peas, most of which would go to the plant cane, leaving 121 pounds

to be supplied by fertilizers in order that the soil may retain the original fertility. It would require over 1,700 pounds of cottonseed meal to supply this quantity of nitrogen, or 970 pounds for first year stubble, and 730 pounds for second year stubble.

It is therefore advisable to decrease the nitrogen in a fertilizer for cane upon a pea fallow, and increase the phosphoric acid- a ratio of one of nitrogen to two of phosphoric acid- would best meet the requirements of cane on such lands. This ratio is about obtained in a mixture of equal parts of cottonseed meal and acid phosphate.

Upon first year stubble - succession plant and second year stubble, the nitrogen should be greatly increased. The ratio may extend from one to one, two to one, and sometimes even three to one, in order to supply the deficiencies of the soil.

Plant cane, particularly in the spring, may very properly receive a portion, and the rest in May. With Fall Planting, the farmer should decide upon the chances of leaching against benefits to his crops by character of soil worked. It is safer if not always more remunerative to apply in the spring.

Stubble cane should not be fertilized until the roots from each sprout are sufficiently developed to appropriate the fertilizer. It has been found by numerous experiments at Audubon Park that fertilizers take best by applying them all at once. Sometimes seasons occur making two or more applications slightly more profitable, but through a series of years one application has given the satisfactory results. The depth at which fertilizers should be placed lies between two and six inches, according to soil and season.

1899 The Great Freeze
(Editorial)

Page 97

(46)

The week now closing will be a memorable one in the history of the Louisiana sugar industry because of the great and unprecedented freeze of Monday night, the 13th of February, when the temperature fell to 7 degrees F., against 13 degrees the night before and 15 degrees January 9, 1886. In 1886 the temperature fell to 10 degrees F. at Donaldsonville and to 14 degrees F. at Point a-la-Hache. At Belair, 30 miles below New Orleans, Monday night, 13th inst., the temperature fell to $10\frac{1}{2}$ degrees F. The record of the country has been broken and it remains to be seen what the effect upon the cane crop will be. Ante-Bellum data is of reduced value to us now owing to many changes that have occurred in cane planting methods, but our resume of February weather from the diaries of Messrs. Vacour Aime and H. O. Colomb will be found very interesting. Mr. McAdie in dis-

cussing the weather with the New Orleans Picayune reports Dr. J. B. Wilkinson as saying that he saw the river frozen out eight feet from the bank in 1823.

In Valcour Aime's diary, which begins with 1827, his report for 1835 refers to 1823 and makes the freeze of the two years much the same. He recorded $9\frac{1}{2}$ degrees F. in St. James and Mr. Brown of Jefferson Parish reported a minimum of $4\frac{1}{2}$ degrees F. We find the sugar crop of 1823 reported, however, at 15,401 tons against 11,807 tons in 1824 and 15,401 tons in 1825.

Evidently the crop of 1823 was larger than was expected. The interesting Ante-Bellum freezing year that many of us now remember was that of 1865. When the sugar crop fell below 36,813 tons against 113,664 tons the year before and 137,542 tons the year after. Valcour Aime's diary closes with 1855, but from it we learn that the temperature from February 4th to 10th, 1856 varied from 7 degrees to 3 degrees Reaumur below zero, or from $16\frac{1}{2}$ degrees F. to $25\frac{1}{4}$ degrees F. above zero. February was slightly colder than January, but the cold does not seem to have accounted for the short crop of 1856. Mr. H. O. Colcumb, in his diary seems to account for the short crop of 1856. On February 19, 1856, he says: "Since December 29th in two months we have ice or frost 26 times and rain 21 times." He reports the cane tops in windrow much damaged by cold. There seemed to have been no dismal forebodings and in fact in the next line Mr. Colcumb reports his purchase of two negro men, two women and three boys for \$4,500 - an evident earnest of his intention to go right along.

The short crop of 1856 seems to have been to a considerable extent the result of the flourishing condition of the sugar industry at that time. The seed was had largely from the tops which were damaged in the windrow by the wet, cold winter and planters being financially able, saved a large part of the cane crop of 1856 to be used as seed cane for the crop of 1857, and as we see the 1856 crop of 38,815 tons was followed by one of 137,542 tons in 1857.

Since the Civil War the effect of great cold upon the cane crop was chiefly in 1879-1881 and 1886. In January 1879, the country was covered with ice by the rain freezing as it fell. Many trees were crushed by the added weight of the ice and cane in the field at the time, about January 8th was broken down by the ice and abandoned. The temperature on the lower coast fell to about 18 degrees F. The seed cane was not especially injured and the diminished crop of 1879 came largely from the delay in planting and working it, because of the long time consumed in harvesting the big crop of 1878.

In January, 1881, the heaviest snow-fall of the century up to that date was recorded, there was much ice and the spring months were cold and the crop fell off one-third

from that of 1880. This serious diminution was not, however, caused solely by the snow and ice. The grinding season of 1880 was the worst ever known from a weather point of view. The largest post-bellum cane crop was in the field, and the rain began falling in October and continued to fall frequently throughout the whole grinding season. The cane rows were cut up by hauling over them, the roads became impassable and much cane was left in the field. This was the year that led to the adoption of the plantation railways, now so common. The falling off in the sugar crop of 1881 came as the result of these influences - rains, cut-up stubble rows, prolonged harvest season, delayed spring planting, etc. The low temperature was not the active factor in the case.

The sugar crop of 1885 was 128,000 tons; that of 1886, 81,000 tons, that of 1887, 158,000 tons. Here we seem to have a positive diminution of 1/3 in the crop, the chief cause of which was the low temperature of January 1886, the lowest recorded since the Civil War until the record was broken this week, (February 13th).

The short crop of 1895 was not the result of the snow and ice of February of that year, but rather of the sugar bounty law in 1894, the grinding up of the cane and the abandonment of the culture in thousands of acres of land.

We have now before us the year 1899 and have had for one day only the lowest record temperature. The winter has been cold, the fall plant and the stubble have not sprouted much. Low temperature has rarely injured seed cane well covered, and our loss, if it comes, will likely come from injured stubbles and we may hope that the short duration of the freeze may have left them not severely injured.

1899 The Preservation of Cane Stubble (47)
 Hon. John Dymond Page 307

The custom in Louisiana for many years has been to have the cane cutter when cutting for the mill to windrow, or cast the cane tops directly on the top of the row, thus covering the row completely. A generation ago, it was thought that this covering of the cane rows was beneficial to the stubbles by protecting them from the possible freezes of the winter, just as our nurserymen secure like protection by placing sacks, straw, etc., over their delicate plants, covering them during the night, when they are apprehensive of injury by frost. This seemed all right for a long time, but occasional field fires occurred during the winter, in many cases this dry covering was burned off. The writer has on many occasions sent out considerable forces to suppress these field fires, which frequently occur by accident or by carelessness and are suppressed to prevent the burning of the unharvested fields. Wherever these burnt

fields have occurred, say during the month of December or January, it was found years ago that such stubbles came up earlier and developed better stands than those that were left to be burned off the first week in March, under the old orthodox method of keeping the stubbles covered as long as there was a possibility of frost.

We have found that while it is eminently proper to windrow the cane tops on the cane stubble rows, that the beneficial effect of this process is not in the protection of the stubbles from freezing weather but from the warm weather of the earlier part of the cane harvest. If we admit then, that the covering of the stubble rows in the field with cane trash is for the purpose of protecting them from the heat and not from the frost or freeze, and that the maintenance of this covering during the rainy season of January and perhaps February will be injurious to the plants keeping them continually moist and tending to rot them, we can readily account for the propriety of burning off our stubble fields as soon as the weather is cold enough to prevent the active growth or sprouting of the stubbles.

Discussion of the above paper. Page 322

Mr. Zenor: Mr. Dymond stated in the meeting some time ago that he had a piece of cane around which there had been more dirt, than usual from the fact that the soil was loose and that the plow threw up a much heavier furrow. He said, it must have covered the mother cane ten or twelve inches deep, and that he had a magnificent stubble, showing that the earth protected the stubble; and we all know that this is about the best protection we can get for anything from the effects of the freeze. I notice, myself, a small piece of stubble where the trash had not been burned off, they attempted to burn it as we ordinarily do, but for some reason or other, it reached the ditch, the fire did not go across it. The stubble adjoining where the trash was burned off turned out very inferior, but on this particular piece of stubble, where the trash had been left and not burned, it was almost as good as you want to see.

Mr. Gleason: "There was a gentlemen on the Teche who died this year, who planted some cane the day before the freeze. He told me he had the cane planted the morning before the freeze, and told his overseer to cover it with the hoe. His overseer wanted to know whether he should cover from both sides of the rows. He told him, no, but to hook in the dirt from one side and when he started to plant again he would cover it up with the plow. He told me that the row that has been covered on one side with the hoe was the only stand of plant cane that he had of that day's planting."

1899 Popular Errors as to the Degeneracy of the Sugar Cane
in Louisiana- (Editorial) Page 420 (48)

Nothing has occurred to confirm this idea until Dr. Stubbs removed the experiment station to its present location and planted his first crop which we made it our business and carefully note changes. As every one that takes an interest in the institution knows, the Professor had there, cane from all cane growing countries. All but one came from the South of us, from hotter climates and longer growing seasons. There were the red and striped canes, apparently of the same variety of our acclimated ones. The above excepted cane was from Japan, in the north of us, and if not necessarily from a colder certainly from a shorter growing season.

When the jointing season came around, our acclimated cane that had learned it seems by experience that they had four more months to grow in made the best of their opportunities and shot out their joints in a hurry. But all the foreign canes from the tropical countries although very green, vigorous, and full of life seemed to think themselves at home yet with full twelve months to grow in, and were moving leisurely on and made but little progress. From what we have seen lately at the park, we are of the opinion that it will take a few more generations before they learn that they are in Louisiana.

Japan cane that had been accustomed for centuries maybe to shorter seasons than our own cane had taken time by the forelock and made better time, running out its joints, etc.

1899 The Economic Cultivation of Cane at Audubon Park
W. C. Stubbs Page 284 (49)

"The economy and efficiency of the use of improved implements in the cultivation of cane has been clearly demonstrated by the following experiments.

Seven years ago Mr. Mallon brought out to the station a cultivator designed to work the middles of the row at one passage. We were then using the disc cultivator and double mould board plow. Not having seen the results of the use of the implement, and valuing too highly the experimental plats in cane to submit measures whose effects than seemed too problematical, we declined personally to use it, but consented to let him try it on a limited scale. Accordingly one plat about one acre in extent was assigned him, and every time we cultivated our plat, he cultivated his. His work and its effect on both soil and cane were scrutinized and we were agreeably surprised to find that during cultivation his soil was better pulverized and his cane more vigorous and verdant during

growth than ours. At harvest all doubts were dispelled by the increased yield of tonnage without detriment to the sugar content. These results changed all of our plans for cultivation. We at once determined to discard all kinds of plows in cultivation, and adopted the following general plan, which we have rigidly preserved ever since, except in a few experiments devoted exclusively to cultivation, namely: as soon as the stand is secured in either plant or stubble cane, the dirt is returned and the middles split out with a two hoe plow and the latter then sent to the tool room to remain until the next season. The first cultivation is made by straddling the cane with the disc cultivator, using three unequal discs running them very shallow and throwing very little dirt to the cane. The middle or diamond cultivator follows working completely the middle of the row. In this operation both mules walk between the canes.

The next cultivation is made the same way, or if the cane is grown considerably and requires more dirt, three unequal discs are removed and two or three of equal size are substituted. These discs can be dished to throw much or little dirt. Having displaced the three unequal discs with those of equal size, the cultivation continues with them, followed immediately by the diamond or middle cultivator until lay-by is desired. Then a single large disc is substituted on each side for the smaller ones on the disc cultivator, and the two forward shovels on the middle cultivator are turned up, leaving only three for work and with these the cane is laid by. This system of cultivation has been pursued for six years on the station with the most gratifying results.

Five different methods of cultivation were adopted and were begun as soon as a stand of cane was secured, before breaking out the middles.

First, the middle was split with two horse plow, and all subsequent cultivations performed with this implement.

Second, the middles were split out with a two horse plow and the subsequent cultivation done with disc cultivator and a two horse plow.

Third, the middles were split out with a two horse plow, and all subsequent cultivation performed by disc and middle cultivator.

Fourth the middles were split out with double mould board plow, and after operations done with disc and double mould board plow.

Fifth, no plow used at all, middles split out with middle cultivator, and after cultivations done with disc and middle cultivator.

These experiments were begun in 1897 and continued.

The following tables give results:

Yield of two years in tonnage

No. 1	62.88 Tons	
No. 2	70.59 tons	Gain of 7.71 tons over No. 1
No. 3	73.72 tons	Gain of 10.84 tons over No. 1
No. 4	69.61 tons	Gain of 6.73 tons over No. 1
No. 5	74.45 tons	Gain of 11.67 tons over No. 1

1901 Louisiana Planter and Sugar Manufacturer Vol. 27,
No. 16, Page 270- W. C. Stubbs (49a)

Cultivation

	First Year		Second Year	
	Stubble	Sucrose	Stubble	Sucrose
	Tons acre		Tons acre	
No. 1	29.61	10.93	21.31	10.38
No. 2	32.48	10.75	25.94	10.40
No. 3	32.80	10.77	27.26	10.46
No. 4	34.00	10.78	27.85	10.60
No. 5	34.48	10.38	31.05	10.75

1902 Cultivation Experiments (continued)
W. C. Stubbs (50)

Plant Cane 1900

	Tons acre	Sucrose
Experiment No. 1	33.41	9.54
Experiment No. 2	35.74	9.66
Experiment No. 3	38.85	9.44
Experiment No. 4	36.20	9.40
Experiment No. 5	39.61	9.29

First Year Stubble 1901

	Tons acre	Sucrose
Experiment No. 1	26.61	10.93
Experiment No. 2	32.48	10.75
Experiment No. 3	34.00	10.78
Experiment No. 4	32.80	10.77
Experiment No. 5	34.48	10.38

"As above remarked the freeze of 1899 destroyed the experiments of that year."

1902 How to Increase the Sugar Content of Cane
J. E. Caldwell

(51)

"Cane planted properly, in land deeply broken, should never thereafter be disturbed, especially by alleged cultivation, cutting all young roots by close off barring. "Off-barr" of course in early spring when scraping off dirt is in order, but never afterwards, for, while you may produce a good and large cane by the process, it will, ipso facto, be low in sucrose.

To gain this time and restore natural conditions, the writer's idea is that when cane is planted it should be planted in a warm soil that may immediately root and sprout, ready to return an hundredfold the farmer's care.

So, as it is cold in the spring, and too cold in November and December, cane should be planted in September that it can become well rooted before frost. Of course frost will kill it to the ground, so to avoid evil consequences the cane up, say on the 15th of November, should be shaved and a heavy furrow dirted over top of row."

The writer reports having done this in the 80's planting cane on September 8th to 10th, securing there from a good yield and a high sucrose content. He reports having repeated this experiment a number of times and having induced others to do so, and that all got good results.

1903 The Irrigation of Sugar Cane
W. C. Stubbs

(52)

Elouin working in Hawaii found that it required 100 pounds water to grow 1 pound of sugar and 400 to 500 pounds water to grow 1 pound of dry matter.

Dr. Maxwell in Australia found that it took 860 to 1,000 pounds of water to grow 100 pounds of sugar.

Stubbs reports that "from one acre under irrigation 12,000 to 16,000 gallons of water evaporate daily."

One inch of rainfall is equal to about 27,000 gallons of water per acre.

Water Requirements for Growth:

Cotton requires	8 to 10 per cent water in the soil
Cow peas require	6 to 8 per cent water in the soil
Sorghum requires	10 to 18 per cent water in the soil
Corn requires	15 to 18 per cent water in the soil
Cane requires	25 to per cent water in the soil

Cane lands should be irrigated when they dry out to 12 per cent moisture.

1904 Southern Agricultural Problems- Sugar
W. C. Stubbs

(53)

(Extract)

"It may be mentioned that in 1844-45, on account of the low price of cotton the cultivation of sugar cane was extended to the upper parishes of this State and to Mississippi. This successful extension of the sugar industry into the cotton fields alarmed the sugar planters of the coast who positively asserted that under the high tariff on sugar of 1842, and the low price of cotton, that the entire cotton belt would go into sugar culture and ruin the industry. This is the only mention in history of the objection on the part of any sugar planter to a high tariff on sugar.

I have already alluded to the tariff and its influence on the sugar industry. The first duty levied on sugar was in 1789 which was augmented in 1790, 1797, and 1800. These duties were imposed at a time when there were no lands within the United States which grew sugar cane and no sugar was grown. In the War of 1812 the duty was 5 cent per pound, but was reduced to 3 cents in 1816. They were levied for revenue only, and the tariff of 1816 continued until the compromise Act of 1832. Since that time sugar has been the political football of each political party, and has been subjected to frequent and severe tariff changes. Since the establishment of the U. S. in 1789, the tariff has been changed twenty times, fluctuating between 3/4 of a cent in 1861 and 5 cents in 1812."

1907 Louisiana Planter and Sugar Manufacturer
Vol. 39

(54)

Note: This is a series of articles on stubble digging and shaving followed by a discussion before the planters association. There was a great diversity of opinion, but most of those dealing with the subject were in favor of shaving and digging, and particularly was this true of the second year stubble.

1907 Seedling Sugar Canes at Audubon Park- The First
Louisiana Seedling Canes Announced (55)

1908 Spring Plant Cane Vs. Fall Plant
H. P. Agee (56)

This article gives data from two years comparative plantings; first, plant cane; second, stubble cane, years 1906-07. Varieties D 74, D 95, Purple and Striped used. Below is the average of the plats.

Plant Cane- 1906

Experiment No. 1	Fall plant 35.5 Tons.	Spring plant 33.0 tons.
	Dif. 2.5	
Experiment No. 2	Fall plant 32.3 Tops.	Spring plat 30.7 tons.
	Dif. 1.6	
Experiment No. 3	Fall plant 33.2 Tons.	Spring plant 31.6 tons.
	Dif. 0.8	
Average in favor of Fall plant	1.6	

Stubble Cane- 1907

Experiment No. 1	Fall plant 27.1 Tons.	Spring plant 23.5 tons.
	Dif. 3.6	
Experiment No. 2	Fall plant 24.6 Tons.	Spring plant 24.6 tons.
	Dif. 0.4 tons	
Experiment No. 3	Fall plant 22.8 Tons.	Spring plant 21.3 tons
	Dif. 1.5 tons	
Average in favor of Fall plant	1.8 tons	

1909 Experiment with Nitrogenous Fertilization
H. P. Agee Page 171 (57)

Extract from:

"The report of the first ten years' results of these experiments contains a discussion of the uncontrolled factors affecting field experiments from which we quote the following: "Another difficulty encountered was that the soil was fresh and had been uncultivated for years, and was so responsive to cultivation that for the first two or three years no fertilizer gave decided results. Maximum crops were made with and without fertilizers and only during the last half of the decade has the effects of fertilizers been apparent." Notwithstanding the high degree of fertility of the soils, the fact remains that the

1907 Seedling Sugar Canes at Audubon Park- The First
Louisiana Seedling Canes Announced (55)

1908 Spring Plant Cane Vs. Fall Plant
H. P. Agee (56)

This article gives data from two years comparative plantings; first, plant cane; second, stubble cane, years 1906-07. Varieties D 74, D 95, Purple and Striped used. Below is the average of the plats.

Plant Cane- 1906

Experiment No. 1	Fall plant 35.5 Tons.	Spring plant 33.0 tons.
	Dif. 2.5	
Experiment No. 2	Fall plant 32.3 Tops.	Spring plat 30.7 tons.
	Dif. 1.6	
Experiment No. 3	Fall plant 33.2 Tons.	Spring plant 31.6 tons.
	Dif. 0.8	
Average in favor of Fall plant	1.6	

Stubble Cane- 1907

Experiment No. 1	Fall plant 27.1 Tons.	Spring plant 23.5 tons.
	Dif. 3.6	
Experiment No. 2	Fall plant 24.6 Tons.	Spring plant 24.6 tons.
	Dif. 0.4 tons	
Experiment No. 3	Fall plant 22.8 Tons.	Spring plant 21.3 tons
	Dif. 1.5 tons	
Average in favor of Fall plant	1.8 tons	

1909 Experiment with Nitrogenous Fertilization
H. P. Agee Page 171 (57)

Extract from:

"The report of the first ten years' results of these experiments contains a discussion of the uncontrolled factors affecting field experiments from which we quote the following: "Another difficulty encountered was that the soil was fresh and had been uncultivated for years, and was so responsive to cultivation that for the first two or three years no fertilizer gave decided results. Maximum crops were made with and without fertilizers and only during the last half of the decade has the effects of fertilizers been apparent." Notwithstanding the high degree of fertility of the soils, the fact remains that the

unfertilized plots are gradually becoming exhausted of plant food, by the continual removal of cane, in spite of the rotation of a crop of peas that is incorporated into the soil every four years, is evidenced by the increasing difference in tonnage as time goes on. This difference is clearly brought out by the results of the last year or two. To illustrate, the figures of the crop of 1908 are given in comparison with those of ten years ago. At that time the excess of one ration of nitrogen alone over no fertilizer was 1.92 tons per acre, while this figure in relation to the 1908 crop was 2.67 tons, nearly twice as great and the difference in the tonnage between two rations of nitrogen and no fertilizer is now 4.87 tons. In the same way it is noted that 4.88 tons for 1908 against 3.91 of former years represents the excess in tonnage produced by one ration of nitrogen, with mixed mineral over no fertilizer; 7.15 tons is the excess of two rations of nitrogen with mixed minerals over no fertilization for the 1908 crop, being greater by several tons than the corresponding figure of ten years previous, which was 4.21 tons.

This is more tangibly expressed in the following summary.

	1908	10 years previous	Difference
The nitrogen alone exceeded no fertilizer	2.67	1.92	0.75
The one ration of nitrogen with mixed minerals, exceeds no fertilizer	4.88	3.01	0.97
The two rations of nitrogen with mixed minerals, exceeds no fertilizer	7.10	4.21	2.94

Melilotus or Sweet Clover

(58)

"We have known of instances here where it has practically destroyed plant cane by invading the fields very early in the spring before the soil was in condition to have the cane scraped. We have since learned to cut the melilotus with the scythe, rather than to permit it to destroy the plant cane."

1909 Variation in Seedling Sugar Canes- Page 178 (59)

Our Louisiana readers are generally quite familiar with the appearance of the noted seedling canes, D 74 and 95. They will further recall the fact that we were advised by Professor Harrison some years ago that these two canes were sprouts from the same seedling cane.

1911 Drainage

Page 20

(60)

The lowering of the water line or the line of water-saturation in the soil, very greatly increases its capacity for retaining the abundant rainfall of the section, prevents the frequent surface flooding so injurious and even ruinous to such crops as cane, corn, vegetables, and the leguminous plants employed in land renovation, conserves the fertilizing rainfall, and gives the crop on the deeply drained ground the full benefit of the moisture beneath its surface.

Even in seasons of drought, deep drainage has the most beneficial effect on the "dryland" crops named. It increases the friability and porosity of the soil thus giving it a greater capacity for the absorption of atmospheric moisture, mostly by night, but even by day; and also gives it the capillary power to draw up the moisture from several feet below the surface of the ground.

In no agricultural lands of America is artificial drainage employed on such a scale as it is in this Southern part of our sugar region. First, it was applied through the water wheels driven by horse-power nearly a hundred years ago. Next, came application of steam to water wheels drainage between seventy and eighty years back. After the Civil War, and up to date, lighter steam driven appliances have been and are being employed for this purpose. We have had the crude, inclined plane elevator a sort of enlargement of the primitive California mining pump, the Gruno water elevator, the Menge pumps, the Ivens rotary pumps, and later the Morris driven by compound condensing engines, and other powerful modern pumps mostly of the centrifugal type, throwing water from the center, creating a comparative vacuum there and compelling the water to rise through such vortex. It might prove interesting perhaps to note the modern drainage pump is a close copy of Nature's process in lifting the water spout in the vortex of a furious whirlwind.

As the Louisiana planter has repeatedly observed there has been no modern appliances so far invented, capable of lifting water four or five feet so cheaply and abundantly as the ancient spur-gearied steam driven water-wheel, which is a simple appliance or lever of the first class, (with the least friction) to the lifting.

1917 Field Work at the Sugar Experiment Station
Audubon Park- W. G. Taggart

(61)

Extract:

"Another fertilizer experiment which has been conducted for five years, and has given some very interesting results, was planned as follows:

No. 1 With approximately 36 pounds nitrogen (cottonseed meal) and approximately 40 pounds phosphoric acid.

No. 2 With approximately 36 pounds nitrogen (cottonseed meal) and approximately 80 pounds phosphoric acid.

No. 3 Check

This same experiment was duplicated, using nitrogen from Tankage. Both have been conducted two years on plant cane D. 74 and Purple, and two years on 1st Stubble, D 74 and Purple, and one year on 2nd Stubble of Purple cane. The fifth year which was 1916, this experiment was conducted on 2nd year stubble of purple cane. An application of 80 pounds of actual phosphoric acid per acre to sugar cane is indeed a heavy fertilization, and in view of this fact, it is remarkable to know that in every instance where this amount was applied to plant cane, or to first year stubble, that with one exception a paying yield was secured. In one section of the cottonseed meal plot negative results were secured from 80 pounds of actual phosphoric acid, and that section could well be eliminated on account of a poor stand and an excess of Johnson grass. If the results from all the eight experiments were averaged, an increased yield of five tons per acre of cane showing average sucrose content, could be credited to 80 pounds of phosphoric acid, over 40 pounds. This can be partially explained by the fact that our soils under constant cultivation probably have become deficient in phosphoric acid though it must be that this material has had a stimulative influence on the growing plant, and assisted it to assimilate more of the other plant foods than it would otherwise have done. In the one case where this excess phosphoric acid was applied to second year stubble, an increase of one ton of cane was shown due to the extra forty pounds of phosphoric acid."

1917 What a Tractor Should Accomplish on a Louisiana Sugar Plantation- T. S. Landry (62)

"I have been asked to prepare a brief outline of what a tractor should accomplish on a Louisiana Sugar plantation- a rather broad subject to cover in a brief outline. Had the paper been left to me it may more aptly have been, "What you Dare Not Attempt with a Thoroughly Modern Tractor on a Sugar Plantation"; "I am satisfied that what you cannot do is infinitely less than what you can do, and do advantageously with this latest product of the human brains as applied to our industry. That we are fast approaching, if indeed we have not already arrived at, the all year round tractor, goes without saying. I might add that until we have reached this very all year round or all operation tractor the mission of our numerous inventors and builders of tractors will have been in vain.

Mr. Inventor and builder, it is imperative that you furnish us not a partial substitute for our prohibitive priced mule, that can and often does die in a night. Give us a substitute that will banish this expensive luxury from the equipment of a modern plantation. That you have tackled and successfully done so with our heavier jobs - what we term our mule killing jobs - such as initial breaking of land, destroying old cane stubble, turning under pea vines, speaks well for you. The more aggressive of you have gone several steps further, furnishing ample belt power for innumerable plantation jobs, such as thrashing our oats, bailing off the resulting straw, operating our feed choppers and mixers, sawing wood and driving of our pumps for water supply, and this last in itself being invaluable as it at once creates a decidedly efficient fire fighting equipment, that so many of our plantations, modern in other respects, are woefully short of, if not entirely without. In addition to these belt jobs, which are by no means all that are possible, you have with more or less success undertaken to operate one or several at a time, of our lighter implements in the actual cultivation of the growing crops. In order to accomplish which, some of you have elected to straddle the crop, others to narrow up and straddle the middle. Solve this problem in your own way gentlemen, but solve it you must, as I repeat we will be content with nothing short of actual laying by our crops with your tractors."

1915 Present Low Yields of Sugar Cane in Louisiana (63)
 W. G. Taggart

Extract:

"We now have one factor left, and in it, I believe, we are to find the change which has brought about the difference in the yields of our lands today as compared to forty years ago. It is quite true that we are cultivating the same lands. But what has been the general history of the agricultural development of this country? Has not the Western movement of the American farmer been a seeking of richer fields after the older ones had been so robbed of their vitality that they ceased to produce an abundant harvest? At least that reason has been assigned for his action, and no one seems to have disproved it. We in the Alluvial lands of South Louisiana have been too prone to believe that they were indistructable. Because our soils are the cream of all those lands lying above us on the Great Mississippi River and its tributaries, is no reason why we can continually rob it of its plant food and then expect it to continue in its productiveness. If we allowed nature to have its way, she would continue to spread upon our fields those rich deposits which she carries out to the Gulf, and between floods we could afford to practice a wasteful agriculture. In order that our property may be safe, we have spent our money to har-

ness nature and can no longer depend on her to furnish fertilizer in the old way, but must now assist her in some other way. Let us measure the amount of plant food which we are removing from our lands, and subtract from that the amount which we put back, and see if that will not largely answer the question for us.

When it was customary for all planters to grow three crops of cane from one planting, if he harvested thirty tons, twenty tons and fifteen tons in the respective years, and burned the tops and leaves on the field, he removed from one acre about 221 pounds of nitrogen, 96.2 pounds of phosphoric acid and 181 pounds of potash. If a fair crop of corn and cow peas are grown after the cane, and the corn in shuck and cow pea hay are harvested, there will be removed about 47 pounds of nitrogen, 30 pounds of phosphoric acid and 135 pounds of potash. The combined crops will remove 268 pounds of nitrogen, 126 pounds of phosphoric acid and 316 pounds of potash. Or if we consider the present average of twenty tons of cane per acre through two years, then the combined amount of plant food from the two crops of cane and one crop of corn and cow peas will be 183 pounds of nitrogen, 89.2 pounds of phosphoric acid and 221.8 pounds of potash.

Suppose we apply fertilizer in the form of cotton-seed meal to all of these crops at the following rates; 300 pounds to plant cane, 400 pounds to first stubble, 500 pounds to second year stubble, with 200 pounds applied to the corn. That I know is some more than is generally used, but the figures will answer our purpose. In this 1,400 pounds of fertilizer we have returned to the soil 91 pounds of nitrogen. Now let us balance this account, and for the sake of brevity consider the most important element. If we consider the four year rotation, we have removed from the soil 268 pounds of nitrogen and returned 91 pounds, leaving a deficit of 177 pounds, or enough to grow over fifty tons of cane, or enough to grow over two and one half average crops of today. If we consider the three year rotation, we have removed 183 pounds of nitrogen, and returned 59.5 pounds, leaving a deficit in the three years of 123.5 pounds, or enough to grow 36.3 tons or one and four-fifths of an average crop. Our fore-runners comparatively speaking, robbed their soil of twelve and five tenths tons of cane per year, and we have improved until we rob ours of only 12.1 tons.

Experiments with commercial fertilizers conducted by Dr. Stubbs have shown that it is not possible for a cane crop grown on our lands as they are today to use plant food in that form to an amount equivalent to the total amount removed by the preceding crop. He has also shown that during an average year, a crop can use profitably 24 pounds of nitrogen and all that can be turned under in a good crop of pea vines.

It is a well known fact that a soil that is rich in organic matter and humus will not only hold more moisture, but will give a better return for the money invested in fertilizers. If we would make better crops of cane we must build up our soils; we must return to the soil some of the plant food which we are not taking away. Pea vines alone when turned under will increase your yields. The ground at the disposal of the sugar experiment station is not sufficient to try out all the things that we would like to try, and we have never run an experiment for a number of years to show just what pea vines turned under would do, but from experiments with other ideas where pea vines were used, I have found the following yields of cane reported.

<u>Year</u>	<u>Kind of cane</u>	<u>Variety</u>	<u>Tons</u>	<u>Remarks</u>
1898	Plant	La. Purple Pea vines turned under	30.51	No other Fert.
1898	Plant	La. Purple No pea vine turned under	21.77	No other Fert.
1900	Plant	La. Purple No pea vine turned under	31.08	No other Fert.
1900	Plant	La. Purple No pea vine turned under	28.14	No other Fert.
1901	Plant	La. Purple No pea vine turned under	32.00	A.P. C.S.M.
1901	Plant	La. Purple No pea vine turned under	30.00	A.P. C.S.M.
1905	Plant	La. Purple No pea vine turned under	41.00	No other Fert.
1905	Plant	La. Purple No pea vine turned under	36.00	No other Fert.

1918 Report of Committee on Agricultural Progress
 Chas. C. Krumbharr, M. Billeaud Jr.,
 Stanley F. Morse, Committee (64)

"Tillage: The average planter does not plow deep enough. Deeper plowing, particularly in the heavy types of soils will increase their water holding capacity and permit roots to penetrate, and feed more deeply, resulting in larger crops. This has been well demonstrated by the J. Supples Sons Planting Company, Ltd., who have been flush breaking their lands with a tractor or the six mule plow for the past eight years.

With good preparation a minimum of cultivation seems to be required. Cutting of roots should be avoided especially in dry weather. Frequent shallow cultivations are usually advisable. Maintenance of Fertility: Little progress

has been made in the maintenance of fertility of sugar lands. Planters generally agree that yields are falling off. While the fiasco of 1914 stimulated attempts at diversification by a number of planters, many of these were ill advised and destined to failure from the start. While a few have made some progress, there has been a general tendency to attempt to rescue losses by planting a large acreage of cane only for the immediate future. This is called successioning and causes a wasteful use of fertilizers and forgetfulness of the fundamentals of soil fertility maintenance. Diversification will be necessary, but this need not involve the abandonment of cane as a principal money crop as some have supposed. This has been proven by some of the planters who have adopted a four year rotation of cane two years and peas two years. Thus, J. M. Burguieres Co. report that at their Cypremort plantation that they are raising the same quantity of cane on fifty percent of their land that they previously produced with the three year rotation on sixty-six and two-thirds of their lands; in addition their cost of production is less and the corn is much greater. The past year more planters have begun to give up successioning and to plow under more pea vines and to preserve and use animal manure. Stated briefly, Louisiana sugar soils are suffering from a lack of humus, nitrogen and phosphoric acid. The problem is to replace these materials in the cheapest practical manner.

Humus must be derived largely from the crops grown on the land itself. Pea vines, cane tops, and corn stalks are valuable sources of humus. When fed to stock or used for bedding, they are returned to the land with the manure. Filter press mud is also a humus forming material. The plowing under or feeding of cane tops is being practised by a few planters.

Nitrogen from chemical sources (obtained from fertilizer or foods) costs about forty cents per pound; when secured from cow peas, velvet beans and other legumes, it costs only about ten cents per pound. The use of a four year rotation with legumes planted on the land two years out of the four will tend to restrict the use of commercial nitrogen to giving the crop a quick start in the spring. The losses of nitrogen from uncared-for manure are appalling. However, some of the planters are paying especial attention to this valuable material "now worth about four dollars a ton", as at Southdown plantation, where all manure is carefully preserved under a large manure shed. Where cattle are fed with cane tops, or corn stalks together with concentrates like cottonseed meal, about eight percent of the concentrates passed into the manure, making it rich in nitrogen. This is demonstrated at the Raceland Plantation of the Leon Godchaux Company, Ltd.

Phosphoric acid can be added only from external sources, either through fertilizers, or through feeds. The cheapest form comes from phosphate rock. Acid phosphate and basic slag are the most available forms. The latter for acid soils. Finely ground rock phosphate contains insoluble phosphoric acid which is believed to become slowly available when mixed with sufficient decomposing organic matter. However, there is not enough reliable information as to its profitability to make any definite recommendations concerning its use by sugar planters. Tests of rock phosphate are being conducted.

Sour Clover, *Melilotus indica*, is a new crop from Arizona. It is being tried as a soil improving crop on top of fall planted cane rows. The Sugar Experiment Station has secured promising results with it. Sour Clover makes nutritious pasture and hay. It is a rapid winter grower."

1919 Report of Committee on Agricultural Progress of the Louisiana Sugar Planters' Association for the Year 1918- Steven C. Munson, W. G. Taggart, W. Supple

(65)

"Maintenance of Fertility - From reports reaching us, we are convinced that the great movement to build up and keep the soil in the highest state of fertility is gaining many friends. The use of commercial fertilizers not being as popular as in years gone by, planters generally are using the soil-building crops, and plowing them under on land suitable for cane. While they are using their stiff heavy lands for hay.

Fertilization - The unusually high price of commercial plant food has had a strong effect upon the amount of fertilizer supplied to sugar cane during the past year. The growing demand made by hog feeders for blood and tankage, has gradually withdrawn one of our sources of nitrogen materials. The use of ammonium sulphate and cyanamid in war industries and the scarcity of bottoms to bring in Chile nitrate, left us largely dependent upon cottonseed meal, some bat guano and shrimp dust for commercial nitrogen. Knowing this, it is not difficult for you to understand why we have but little to report on so important a subject. The very scarcity of our most important plant food has driven some men to look for new sources of nitrogen. We find that one man has tested nitre cake as a cane fertilizer. He, however, has not gotten far enough along to report as to its value. The usual tests with lime in its various forms and of raw rock phosphate continues to be interesting to some planters. Reports of benefits from the use of lime on stiff land grow in number. The experiment stations are of the opinion that raw rock phosphate is profitable only to the man who can afford to wait for his returns. Fertilizer tests at the Sugar Experiment Station are in keeping with previous reports."

1920 Report of Committee on Agricultural Progress to the Louisiana Sugar Planters' Association
T. S. Landry, C. B. Gouaux, and R. G. Comeaux (66)

The good sugar crop of 1918 the long drawn campaign, which was occasioned partly by the war, the flu, bad weather, and the resulting shortage of labor, left a lot of things undone for the year 1919, which will long be remembered in the annals of the Louisiana Sugar Industry. The rains began in the early fall of 1918 and continued throughout the ensuing year. The result of the unfavorable weather conditions and in the majority of parishes varied from fifteen to forty percent of a normal crop. In a few favored sections in the parishes of Lafayette, Iberville, West Baton Rouge, and Pointe Coupee, where there was a little less rainfall, the planters fared better and produced from forty to eighty per cent of the normal crop.

Preparation of the Land - The rainy spell that prevailed during the fall and Spring months made it a very difficult matter to prepare land for cane as it was, the planters, did the very best they could and were compelled to plow at times when the land was too wet. Very slow progress was made and in a good many cases very little cane was planted in the fall. In the Spring the bad weather continued and most of the land was prepared wet. Under such conditions planters were forced to plant their cane in lands that were unprepared in a packed condition and soaked up with water from excessive rains.

The general practice in the sugar district in the application of fertilizers is to fertilize only the stubble cane. As a rule the land of the plant cane crop has been in peas, and has either received all of the crop or one third of the crop as green manure. This gives a sufficient amount of nitrogen to easily take care of a good crop of cane. However, while the peas enrich the soil in nitrogen, no phosphoric acid is added, and as phosphorus is one of the essential plant food elements, cane crops on such lands, while they yield heavy tonnage generally, produce juices that are a little low in sucrose. On the Raceland properties in Lafourche, straight application of acid phosphate at the rate of 200 pounds per acre to plant cane has improved the sucrose yield of plant cane crops."

1921 Report of Committee on Agricultural Progress of the Louisiana Sugar Planters' Association for the Year 1920 - C. B. Gouaux, J. M. Caffery, and E. Jones (67)

Extracts: "The 1920 crop was made with a normal expectancy of 15 cents for sugar."

"The bad crop of 1919 gave the year 1920 setbacks in the way of poor seed for the plant cane, and poor stubble

from the previous years plant cane. With these obstacles before them, planters began their field operations with determination to overcome them by thorough cultivation and fertilization."

"It was the scarcity of labor, high wages and high priced mules and scarcity of feed that caused tractors to come more to the front in 1920. The four wheeled 12-20 tractor and Thompson plow was used for destroying stubbles. The caterpillar type of tractor was used in an extensive way on Mathew's Georgia Plantation."

"Much dissatisfaction was found on account of breakdown short life of tractors and inefficiency of drivers. Mathews put in the gang tractor system under two sets of mechanics. One at shop and other servicing them."

"Tools to go with tractors were home made."

Stenographic Report of Discussion of Above report,
Page 202.

Taggart reports to the Association that on account of Federal Quarantine Regulations, he was unable to bring in the P.O.J. canes and asks for assistance from the planters.

1921 Sugar Experiment Station Work
(Editorial) (68)

Extract: "A mixture carrying seventy-two pounds of phosphoric acid with its ration of nitrogen gave an increase of 131.5 per cent, while one with 36 pounds of phosphoric acid and an equivalent of nitrogen gave only 26.6 per cent increase."

1921 Tractors and the Right Implements Solving Sugar Plantation Problems- W. G. Taggart (69)

"This article describes a new tool which was a modification of the Avery's Magnolia Cultivator to fit a tractor. It was the first one man power lift tool to come into the sugar belt."

1922 Report of the Committee on Agricultural Practice, Etc.
 The Louisiana Planters and Sugar Manufacturer,
 Vol. LXVIII, No. 10, Page 159.
 (Not signed) (69a)

Notes from: First acreage of melilotus on plantation reported by Mr. Lebermouth who planted 500 acres with satisfaction. Bowie Lumber Company reported to have sown Sour Clover on all Fall Plant Cane.

1923 Sugar Planters of Iberville Parish report Wonderful Success with Melilotus Indica- Louisiana Planters and Sugar Manufacturer, Vol. LXX, No. 10, page 191.
 B. B. Mackay (69b)

Actually returning to the cane planters of the state \$20.00 to \$45.00 per acre from \$1.25 expected on Melilotus.

County agent Roemer gets busy, orders for a car of seed.

1923 Report of the Committee on Agricultural Progress of the American Sugar Cane League of the U. S. A.
 D. N. Barrow, L. W. Wilkinson, Lewis E. Murrell (70)

This is a long report based on the decreasing yield of the cane crop. It stresses the fact that in the Committees' mind the chief difficulty lies in the fact that "Decreased Soil Fertility is the Prime Cause for Fluctuation in Yield", and that this "Decrease in Soil Fertility Has Shortened Rotation." A Chemical Balance sheet of the soil fertility is given to show the amount of fertility that was taken from the soil in crops and the amount returned to the soil by the planters. It further shows the deficiency, and this is used as an argument for explaining the fact that, "Commercial Fertilizer Not Able to Maintain Yields."

The Committee next discusses the fact that "One crop of peas not sufficient to maintain yields" and further discusses the fact that "Two Years of Corn and Peas Effective but Expensive".

The most important subject discussed in this paper is under the heading "Melilotus indica solves the Problem".

Extract: "If it had never done anything else of value for the sugar industry The Sugar Experiment Station where we are now gathered has justified and proven its value in the solu-

tion of this all important question. For it is through its investigations that we now know how to produce two crops of legumes upon our cane lands in the one year that was formerly devoted to peas."

"Figures obtained by the Sugar Experiment Station, show that a normal growth of Melilotus will produce 3,600 pounds of dry matter, which when turned under supplies 104 pounds of nitrogen. As this crop is grown right upon the Fall plant cane, and follows a crop of peas grown the summer before we thus have two legume crops grown upon the land between the last stubble crop and the next plant cane."

"A normal growth of pea vines turned under (2 tons of dry matter) will have supplied 78 pounds of nitrogen, while this crop of melilotus following it will add another 104 pounds. Thus, our crop of plant cane has a supply of 182 pounds of readily available nitrogen at its disposal the following Spring. The two previous crops of cane removed 136 pounds of this essential element of plant food; so instead of a deficiency of 56 pounds of nitrogen, we have an actual surplus of 46 pounds over land in which melilotus has not been planted."

Mr. O. C. Roemer, County Agent for Iberville Parish, realizing the value of the plant bestirred himself to the extent of inducing the plant of forty five hundred acres during the Fall of 1921.

"He reports that from these plantings there was realized upon eight plats an average increase of cane of 5.3 tons with a minimum increase of 3.1 tons. Mr. Murrell reports that in 1921 he sowed eight acres of plant cane to melilotus out of a plat of 16 acres. All was planted in D 74. The soil was a cold sandy soil, found upon ridges of old bayou banks. Cane was planted down the early part of November and clover sown on top and rolled in with cultipacker about the first of December. Early in February, five of the eight acres sown in clover were scraped, the balance not scraped until March. On examination the first cane scraped, I found it sound and of original color, while the scraped in March was sound but brownish in color. The last scraped had almost twice the clover of the first. The clover was removed with a Magnolia, and much of the cane was more or less damaged. Plot of ground not planted to clover, was scraped with hoes, with less damage to cane. The subsequent cultivation was the same. Both plats were harvested about December 15. Plat one, (clover), averaged 23 plus tons, while plat two (no clover) averaged scant 21 tons. Soil of plat one became very light and loose, and remained so even after heavy rain, while plat two packed badly after each rain. The analyses showed a sucrose content of 12.91 with purity of 81.7. The analysis of the other plat was close to this, but with

the advantage slightly in favor of clover."

1925 Legumes on Cane Fields
Patout Burguières (71)

"My five years experiments convince me that the soybean is the legume that my land is best adapted to."

1929 The Possible Expansion of the Louisiana Sugar Industry
I. H. Morse (72)

Extract: "While it will be admitted that the decline during the last ten years has been due very largely to the mosaic disease combined with several unfavorable growing seasons, yet this does not account for the sudden stop in the expansion during the 90's and the decline in production between 1893 and 1919. During this period there was no curtailment of consumption of sugar in the United States and all of the other cane sugar countries increased their output considerably. If the same proportional increase had taken place during the last thirty years as was reached during the ten years previous, the tons of sugar made in Louisiana would have been 1,112,000 tons instead of 91,000 tons. This period includes the four years of the great war, when the prices of sugar and molasses were very high, and the profits of sugar cane manufacture were enormous. Even this unusual political condition failed to stop the steady decline in production.

The reason for the decline in the production of cane sugar in the sugar belt of Louisiana during the past thirty years, in the opinion of the writer and substantiated by ample proof, can be traced directly to changed economic conditions which have taken place, the two most important being the almost universal use of refined sugar by the consumer and the introduction and adoption of the central system by the cane farmer of the State. The sudden loss of their profitable market for "Yellow Clarified" sugar forced the cane farmers to adopt methods of reducing the cost of production and this was done very largely by abandoning their small and inefficient sugar houses and erecting modern central factories, where large quantities of cane could be ground and better recoveries secured. But with this gain in the reducing the cost of production by better mills and machinery, there was found other items which had not been expected, the use of the railroad for transporting cane from distant points, the loss of cane in transit and the deterioration of the cane itself due to the long period that occurred

between the cutting of the cane and the final grinding at the central factory. Then there sprang up among the various large centrals a certain amount of competition in the purchase of cane, and led to a serious distress among the smaller planters, who depended on the cane grown in their vicinity for operating their mills and who found their supply taken away from them by the central factories representatives, leaving them without an adequate supply of cane for their grinding season. To what extent the central factory system has been adopted may be in the following table, which shows the number of steam operated sugar houses grinding during the 1880 campaign with the sugar houses in existence in 1928; forty-eight years later.

	1880	1928
Total	870	138"