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Twenty-Eighth annual report of the agricultural experiment stations of the Louisiana State University and Agricultural and Mechanical College.

W R. Dodson

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TWENTY-EIGHTH ANNUAL REPORT

OF THE

Agricultural Experiment Stations

OF THE

Louisiana State University and Agricultural and Mechanical College

FOR 1915

TO THE GOVERNOR

By W. R. DODSON, Director
Louisiana State University and A. & M. College

Louisiana State Board of Agriculture and Immigration

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STATION STAFF

W. R. DODSON, A. B., B. S., Director, Baton Rouge.
W. G. TAGGART, B. S., Assistant Director, Audubon Park, New Orleans.
A. P. KERR, M. S., Assistant Director, Baton Rouge.
C. E. HESTER, B. S., Assistant Director, Calhoun.
F. C. QUEREAU, M. S., Assistant Director, Crowley.
H. MORRIS, D. V. M., Bacteriologist and Assistant Veterinarian, Baton Rouge.
C. W. EDGERTON, Ph. D., Plant Pathologist, Baton Rouge.
C. C. MORELAND, B. S., Assistant Plant Pathologist, Baton Rouge.
C. W. DAVIS, Assistant Plant Pathologist, Baton Rouge.
F. V. EMERSON, Ph. D., in charge Soil Survey Work, Baton Rouge.
E. W. KERR, M. E., Mechanical Engineer, Baton Rouge.
G. L. TIEBOUT, B. S., Horticulturist, Baton Rouge.
J. B. GARRETT, B. S., Entomologist, Baton Rouge.
E. S. TUCKER, Assistant Entomologist, Baton Rouge.
W. L. OWEN, B. S., Bacteriologist, Audubon Park, New Orleans.
M. A. SCHNELLER, Ph. D., Chemist, Audubon Park, New Orleans.
G. D. CAIN, B. S., Chemist in Charge of Fertilizer and Feed Stuffs Laboratory, Baton Rouge.
J. M. JENNINGS, M. S., Assistant Chemist, Baton Rouge.
S. BYALL, B. S., Assistant Chemist, Baton Rouge.
I. SELECTER, B. S., Soil Chemist, Baton Rouge.
W. M. HALL, B. S., Assistant Chemist, Baton Rouge.
W. P. DENSON, B. S., Assistant Chemist, Baton Rouge.
MRS. EDITH STRONG, Secretary to the Director, Baton Rouge.
MISS MAYME DWORAK, M. A., Scientific Assistant in Charge of Seed Laboratory, detailed by U. S. Department of Agriculture, Baton Rouge.
J. K. McHUGH, Clerk and Stenographer, Audubon Park, New Orleans.
R. P. SWIRE, A. B., Treasurer, Baton Rouge.
C. B. ANDERS, B. S., Assistant Animal Husbandman, Baton Rouge.
R. C. CALLOWAY, B. S., in Charge of Dairy, Baton Rouge.
A. D. SUMMERS, Farm Manager, Baton Rouge.
C. J. BARRILLEAUX, Farm Manager, Audubon Park, New Orleans.
J. A. WEDGEGORTH, Mailing Secretary, Baton Rouge.
To His Excellency, Luther E. Hall,
Governor of Louisiana:

Sir—I am pleased to submit herewith the annual report of the Experiment Stations of the Louisiana State University and Agricultural and Mechanical College for the year 1915. As required by act of the National Congress of March 2, 1887, providing federal aid for experiment stations of the several states, and in accordance with act of March 2, 1906, providing additional federal funds for research work at the experiment stations of the several states, a financial statement is submitted for the year beginning July 1, 1914, and ending June 30, 1915.
FINANCIAL STATEMENT.

The state appropriation for the experiment stations is kept in a separate account from that of the federal funds, as will be shown by the complete financial statement submitted herewith.

HATCH AND ADAMS FUNDS.

Dr. HatchFund AdamsFund
To receipt from the Treasurer of the United States as per appropriation for fiscal year ending June 30, 1915, under Acts of Congress approved March 2, 1887 (Hatch Fund), and of March 16, 1906 (Adams Fund). $15,000.00
Cr. $15,000.00

By salaries 9,831.52 11,554.06
Labor 2,537.63 405.36
Publications 1,040.68 ........
Postage and stationery 12.40 22.91
Freight and express ........ 65.86
Heat, water and lights ........ 209.35
Chemical supplies 9.30 36.04
Seeds, plants and sundry supplies 141.10 133.09
Fertilizers ........ ........
Feeding stuffs 790.43 526.75
Library 89.25 79.63
Tools, machinery and appliances 26.82 23.90
Furniture and fixtures ........ 1,191.47
Scientific apparatus ........
Live stock ........ 191.60
Traveling expenses 20.00 374.52
Contingent expenses ........
Building and repairs 500.87 ........

$15,000.00 $15,000.00
STATE FUND.

(Dec. 1, 1914, to Nov. 30, 1915.)

**Receipts**—

Received from the State Treasurer $24,500.00  
Miscellaneous sales 5,119.66  
Refunds 806.92  
Interest on daily balances 85.19  
Fertilizer and feedstuffs fund for station accounts 3,000.00  
Deficit Nov. 30, 1915 2,132.69

**Total Receipts** $35,644.46

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**Expenditures**—

Salaries $10,344.78  
Labor 5,203.64  
Publications 643.46  
Postage and stationery 488.13  
Freight and express 574.44  
Heat, water and light 326.10  
Chemical supplies 31.67  
Seeds and sundry supplies 1,423.12  
Fertilizer 431.43  
Feedstuffs 1,354.39  
Library 92.19  
Tools, implements and machinery 1,054.80  
Furniture and fixtures 303.76  
Scientific apparatus 29.06  
Live stock 4,374.43  
Traveling expense 1,483.96  
Contingent expense 1,589.52  
Building and repairs 4,401.41  
Deficit Dec. 1, 1914 1,494.17

**Total Expenditures** $35,644.46
FERTILIZER FUND.
(Dec. 1, 1914, to Nov. 30, 1915.)

Receipts—
Commissioner of Agriculture ....................... $17,000.00
Miscellaneous sale ................................ 4.00
Refund ............................................. 40.00

Expenditures—
Salaries ........................................... $ 7,535.86
Labor ................................................ 874.02
Postage and stationery ......................... 333.49
Freight and express .......................... 101.90
Heat, water and light ......................... 814.89
Seeds and sundry supplies .................. 293.08
Feedstuffs ...................................... 9.45
Chemical supplies ............................. 832.35
Library ........................................... 4.21
Furniture and fixtures ....................... 38.03
Tools, implements and machinery ........ 2.08
Scientific apparatus ......................... 400.30
Traveling expense ............................ 85.97
Building and repairs ......................... 131.55
For station accounts ......................... 3,000.00
Deficit Nov. 30, 1914 ......................... 414.94
Cash on hand Nov. 30, 1915 ................. 2,171.88

$17,044.00

AUDUBON PARK REPAIR FUND.

Receipts——
State Treasurer ................................... $ 2,000.00

Expenditures—
Building and repairs ......................... $ 2,000.00

The Louisiana law requiring the semi-annual publication of the statement of receipts and expenditures has been complied with, and all accounts have been examined quarterly by the Supervisor of Public Accounts and found satisfactory. A representative of the United States Department of Agriculture has also examined the books and vouchers of the federal funds and has given his approval to all expenditures.
On the whole, the work of the stations has made satisfactory progress and we have had no important change in the personnel of the Experiment Station staff.

During the year as Director of the Stations, I have continued to act as Dean of the College of Agriculture and Director of the Agricultural Extension Work under the Smith-Lever Act. I have also continued to serve as a member of the committee of three in the management of the Iberia Experiment Farm under the auspices of the federal government. I have also served as directing official for the Live Stock Extension Service conducted by the federal government in cooperation with Louisiana State University during the past year. With these many duties to discharge, it has been impossible to give as much attention to the Experiment Stations as their importance would justify, but we have been fortunate in having a competent assistant at each station who has served for several years in this capacity, and who is thoroughly familiar with all of the details of the work.

SHORT COURSES AND AGRICULTURAL FAIRS.

Most of the members of the Experiment Station staff have given a portion of their time to what might properly be called extension work in aiding parish fairs, the state fair, and the numerous short agricultural courses that have been held in different portions of the state. The growth of the extension work of the institution and increasing funds to provide for it is gradually diminishing the necessity for spending experiment station money for work of this kind, and it is to be hoped that in the near future, experiment station funds can be used exclusively for research work.

EXPERIMENT STATION DAIRY.

In October, 1915, a herd of Holstein cattle was added to the dairy with the view of making some practical tests of the adaptability of this breed for the utilization of some of our available forage crops comparing the cost of keep and the amount of product given with the record of the Jerseys. To aid in carrying
out the plan outlined in the college course for giving instruction in dairying, the Experiment Station Dairy has ceased to sell milk at retail, delivering the entire product to the L. S. U. Creamery.

FERTILIZER AND FEED STUFFS LABORATORY.

The laboratory of the Experiment Station at Baton Rouge has continued to analyze the samples of feed stuffs and fertilizers for the State Board of Agriculture and Immigration as usual. It would seem, however, that this is almost a useless work under the present method of administration of the law. If a fertilizer or feed stuff falls below the guarantee or is otherwise fraudulent, no steps are taken, so far as I know, to stop the perpetration of the fraud. It would be a relief to the Experiment Stations to either have the law amended so as to make it effective, or have the names of the members of the Experiment Station staff disassociated with the work.

STATION No. 1, SUGAR EXPERIMENT STATION

Audubon Park, New Orleans.

W. G. Taggart, Assistant Director.

The year 1915 is one that will long be remembered in the history of this station. It is remarkable that the annual rainfall, 73.69 inches, surpasses the precipitation for any other year on our records, and that during this same year we suffered one of the most severe droughts, practically no rain falling from March 4 to May 6. On September 29, we were visited by a hurricane which did heavy damage to out buildings and fences, and interfered with our field experiments.

The results from potash fertilizer test on sugar cane were unusual for this station. A complete fertilizer containing ninety pounds sulphate of potash per acre showed an increase over check plots fertilized with equal amounts of nitrogen and phosphoric acid without potash, of 3.03, 3.55 and 1.73 tons.

A comparative test of the newer nitrogenous materials with well known nitrogenous fertilizer indicates that calcium cyan-
amid will rank close to nitrate of soda and sulphate of ammonia, and probably is better than tankage. The difficulty of mixing it with acid phosphate still exists, and unless this material could be had at a more reasonable price than nitrate or sulphate, the cost of applying it, as the exclusive source of nitrogen, would likely decrease its usefulness. Calcium nitrate has not proven as satisfactory on cane as on corn.

An experiment with varying quantity of phosphoric acid used with a constant quantity of nitrogen has been carried on for four years on cane; a mixture of 500 pounds of cottonseed meal and 250 pounds of acid phosphate shows an increase of 2.7 tons over no fertilizer, while a mixture of 500 pounds of cottonseed meal and 500 pounds of acid phosphate per acre, shows an increase of 8.9 tons.

A duplicate of the above experiment using tankage as a source of nitrogen, shows an increase of 1.4 tons in the first case, and 8.4 tons in the second case. These figures are an average of two years plant and two years first year stubble, eliminating one section in the first experiment with cottonseed meal.

In April it was decided to take advantage of the drought to demonstrate the value of irrigation. A one-inch pipe line was connected to the city water and water equivalent to one and one-half inches of rain applied on three separate dates, April 29, May 17, and May 26. While this small quantity of water was not sufficient to answer the full needs of a growing crop, it was sufficient to cause an increase of 7.6 tons of cane over an unirrigated check plot.

Propagation of new varieties of sugar cane by growing seedlings as our most important field work has been continued. Seedling L 511 made a good growth and showed a sucrose content of 14.9 per cent. in juice; this being 4.5 to 5 per cent. higher than the juice of the cane grown on the average plantation. L 231 is probably the next best variety in our possession, and should grow a much larger tonnage than D 74 and is as rich in sugar as Louisiana Purple. L 218, 219, 226, 253, 294, 454 are all good canes. The demand from planters for these varieties is heavier than our supply will accommodate. Four hundred and ninety-four new seedlings were propagated and transferred to our plots.
The work of developing a white flint corn has progressed. A white flint corn very similar to Yellow Creole has been grown, and our next endeavor will be to fix a type.

Experiments as to the time of applying fertilizers to corn seem to show that application before or after planting is optional; corn fertilized before planting yielded 49.85 bushels, while corn fertilized after planting yielded 51.45 bushels.

A comparative test of cow peas, velvet beans and soy beans as a green crop to be turned under seemed to give the velvet beans a slight advantage.

The use of bagasse as a source of fertilizer seems to indicate that bagasse has no value in that respect. Corn grown on land where bagasse has been applied for three years yielded five bushels less than corn grown on land where nothing had been applied. At the same time, corn grown on land where cowpeas had been turned under for three years, yielded fifteen bushels more than the bagasse plots. Nitrogen applied to corn over bagasse for three years consecutively has given unsatisfactory results, and will be discontinued.

Other fertilizer experiments with corn are: First to determine the proper proportion of nitrogen and acid phosphate; second, the most economical quantity that can be used in connection with peavine fallow. To date, the only point clearly indicated in the responsive power of stiff soils to peavine fallow as well as to nitrogenous fertilizers. Weather conditions have interfered with these experiments.

Variety tests with corn continue to indicate that, in general, Yellow Creole is most suitable to local conditions as a general field crop.

Alfalfa was grown successfully; 8.6 tons of cured hay per acre being produced. With such yields this crop could be grown as an annual.

Clovers, oats and vetches suffered from unfavorable weather at time of planting, and no valuable data was secured this year. Kudzu has made a wonderfully rank growth, and a large amount of forage. Plants put out three years ago produced such heavy growth this season that the Johnson grass in adjacent plots has been overrun and almost completely smothered out, suggesting
the possibility of utilizing kudzu for the eradication of this pest, as well as for the production of forage.

The co-operative laboratory of the United States Bureau of Entomology has imported a parasite of the cane-borer (Tachino phyto). We are glad to report that the new parasite has taken hold.

Poisoning with arsenate of lead decreased the borer infestation from 24 per cent. to 5 per cent. Both of these experiments will be vigorously prosecuted during next year.

The Luce cane harvester was tried out, merely for adjustment, before going out on plantations.

The James Mallon steam turnplate was tried during the grinding season and showed an increased sucrose extraction of 5.88 per cent. and delivered a bagasse containing 55 per cent. moisture against a bagasse containing 62 per cent. moisture, using no maceration.

The eighth annual field day meeting of the Louisiana Sugar Planters’ Association was successfully held on the grounds June 10.

BACTERIOLOGICAL DEPARTMENT
W. L. Owen.

Project 1. A Study of the Deterioration of Sugars, and Principal Factors affecting same.

The “factor of safety” of the Colonial Sugar Refining Co., of Australia, is that the moisture of a sugar should not be more than half the non-sugars, or when \( P = \frac{w}{100} \) the sugar will not deteriorate. A study of 46 samples of sugar, procured from various plantations throughout the state, showed forty per cent. to be safe from the above factor. Sixty per cent. of the samples deteriorated when stored in the incubator, where they were exposed to an elevated temperature and high humidity. The average per cent. of moisture for the deteriorated sugars was 1.64, the minimum 1.26 with a factor of .488. The average degree of infection of the deteriorated samples was 245,102, while that of the good keeping samples was 5,580. Of the samples that did not deteriorate the maximum infection was 11,000 with a factor of
.242, while the minimum degree of infection of the deteriorated samples was 2,200 with a factor of .488.
Of the plantation white sugars kept under observation only 14% deteriorated under natural conditions, while 71% were safe according to the factor. The average degree of moisture of the deteriorated samples was 0.43% with a minimum of 0.17%, the latter having a factor of .340, while the average degree of moisture of the good keeping samples was .03 with a maximum of .06.

From these results, it appears that neither the moisture alone, nor when used in conjunction with the factor of safety, furnishes a reliable criterion of the keeping quality of a sugar, but that its degree of infection must also be taken into consideration. This investigation is to be continued with particular reference to the influence of the non-sugars upon deterioration, and of the influence of moisture and acidity. A large number of samples of plantation sugars have been collected from this year's crop. The co-operation of the planters was again most gratifying, and this co-operation was doubtless encouraged by the reports made to them from this station on the behavior in storage of the samples donated last year.

Project 2. A study of the species of microorganisms causing deterioration of sugar was carried out during the year with a view of determining (1) the relative deteriorative ability of the different species. Eighteen cultures of bacteria and twenty cultures of yeast were obtained from sugar. There appears to be considerable variation in the deteriorative power of the different species, which is not altogether obliterated by repeated cultivations. Sugars from widely distant countries show no greater variation in this respect than sugars from adjoining plantations. In order to determine the principal sources through which sugars become infected with deteriorative microorganisms, some experiments were conducted during the past grinding season in connection with the experiment station sugar house. It was observed that the microorganisms found in sugars do not predominate either in the mill juice, or on the cane leaves. Analyses showed these sugar deteriorative forms to occur only to the extent of 19.5% in the fresh juice. From this point they increase to 46%
and 91.5% in the sulphured and defecated juice respectively. The filter press appears to be the vital point in determining the infection of the finished sugars.

The aid at the centrifugal was found to average 5,683 microorganisms per liter, the predominant species of which were of the deteriorative type.

Project 3. The identification and study of the action upon the purity of cane juice, of a certain species of bacteria commonly occurring in the interior of borer-infested cane.

This investigation resulted in finding this to be a distinct and hitherto undescribed species of bacteria, to which we have given the name bacterium saccharum officinarum. Inoculation experiments upon cane showed, however, that it is not a great factor in the deterioration of the juice of the growing cane, hence its presence there does not apparently aggravate the deterioration following borer infestation.

Project 4. A study of the bacterial flora of cane juice with particular reference to these species, which are active in the various spontaneous fermentations that this product undergoes. About twenty cultures of bacteria have been isolated, among which are many interesting chromogenic forms, and others which appear to be undescribed species. The identification and study of these species is to be reserved for a future time. The presence in a living condition of a number of yeast forms, in filter press juice collected under aseptic conditions, indicate a thermophilic tendency on the part of these species, which suggests a further study of their characteristics, and the part they play in deterioration of sugar house products.

RESEARCH CHEMICAL DEPARTMENT

M. A. SCHNELLER

Project 1. The chemical department is conducting a research into the nature of the coloring matters of sugar cane. The results so far obtained show that substances belonging to the polyphenocle are present in cane, especially the eyes and tops, and cause in connection with iron the dark color of juice and syrup. The action of boiling temperatures and sulphur dioxide in the sugar houses, results only in a temporary decomposition and reduction of the
polyphenol iron compound and decolorization of the products. The darkening of plantation white sugars in storage must be sought in reoxidation of adhering or occluded traces of the iron-polyphenol. Decomposition products of a similar nature (glu- cinic acid) are also formed by the action of lime at alkaline re-action on glucose. Alkalinity is, however, avoided in the white sugar manufacturing in this state. A means of elimination of the polyphenols could be found in the bone-black process, generally discarded as too costly. Elimination of iron by secondary car-bonation, or a similar process has the same result, but would be successful only if further contact of theliquors with iron were completely avoided. Lining of the iron equipment with rustproof enamel might lead to a distinct improvement.

The incrusting coloring matter of cane fiber, although perhaps the physiological product of the above mentioned poly-phenols and of a similar chemical composition—coniferin or a de-rivative—does not yield dark-colored iron compounds and owing to its firm combination with the lignin of the cell walls is only sep-arated with difficulty and would not easily pass into the juice.

Project 2. Another object of investigation pertains to the methods of direct sucrose determination in the presence of re-ducing sugar based on the action of small amounts of alkali on the rotary power of the latter.

The summary of these experiments in that several sources of error are inherent to these methods:

(1) The residuary levorotation, introducing a considerable error, especially with material high in reducing sugar and with methods using a weak concentration of alkali.

(2) Stronger concentrations of alkali reduce this levorota-tion, but introduce a second serious error due to the decrease of sucrose rotation by the neutralized alkali.

(3) The incidental use of oxidants (as hydrogen peroxide) causes also destruction of sucrose. Apparently correct results are possible by compensation of errors due to 1 and 3.
STATION No. 2, STATE STATION.
Baton Rouge.

A. P. KERR, Assistant Director.

The following is a brief statement of the projects that have been carried on at this station during the year 1915.

Project: Silage Production.

As the production of silage is one of the most important problems to the beef and dairy industry in this state, experiments were started to ascertain the cost of production and the feeding qualities of silage from Japanese cane, corn, sorghum and soy beans. Also to determine the influence on soil fertility from continued cropping with these crops, returning to the plots the manure produced while the cattle are consuming the silage from the respective plots.

The silage made from Japanese cane is not of as good quality as that of corn and sorghum alone, or corn and sorghum mixed with soy beans. Although cattle will eat it if fed in connection with cottonseed meal or molasses and very good results can be secured, it is impossible to get them to eat as much of this silage as they will of the corn and sorghum. Since Japanese cane grows from stubble each year and needs very little cultivation, the cost of production is very light, although it costs nearly twice as much to harvest this crop as it costs for corn and sorghum, because it must be harvested by hand. On ordinary land Japanese cane will produce twenty-five to thirty tons per acre.

Soy beans planted in rows and cultivated, must be harvested with a mowing machine and raked up. Until the tonnage reaches about ten, soy beans will produce about as much silage per acre as corn.

We have found that a mixture of corn and soy beans gives better silage than any kind of silage that we have tried. The protein content is about three times greater than either corn or sorghum silage alone.

This experiment has not been conducted a sufficient length of time to give accurate data regarding the increase of soil fertility from the application of the manure to the respective plots.

Project: Commercial Fertilizer.
The object of this experiment is to determine the influence of the application of commercial fertilizer to corn land at different intervals. Results indicate that there is practically no difference in the yield from the application of all of the fertilizer before planting, all during cultivation, or half before planting and half during cultivation.

Project: Corn Culture.

The object of this experiment is to determine the influence of removing suckers from corn. The yield of corn from this experiment showed a slight increase where the suckers were removed, but the increase was not sufficient to compensate for the labor used in removing the suckers.

Project: Corn Culture.

The object of this experiment is to determine the influence of clover, cowpeas and stable manure in increasing soil fertility. A plot where cowpeas were planted with the corn when it was laid by, followed by a crop of clover in the fall with a light application of stable manure every three years, produced about five times as much corn as a plot receiving the same cultivation without an application of stable manure or the turning under of leguminous crops.

Project: Forage Crops.

Of the new forage crops recently experimented with, Sudan grass seems to be the most promising. We find that the best time to plant Sudan grass in this locality is about April 1st. Twenty pounds per acre seems to be the best quantity of seed to sow. On thin land the yield is about two to three tons per acre, but on rich soil a yield is secured of eight to ten tons per acre. The crop should be cut for hay just as it is coming into bloom.

Project: Varieties of Corn.

About twenty varieties of corn have been tried under the same conditions with variable yields. The Calhoun Red Cob, Yellow Creole, and a few others, have given best results in yield and in keeping quality.

Project: Ramie.

From the standpoint of production ramie is a very successful crop in this state, but up to the present time machinery has not been perfected for profitably decorticating the fibre.
Project: Special Selection of Seed Corn.
A careful test is being made of the selection of seed corn in the field for the improvement of varieties.

Project: Velvet Beans.
For the past two years we have carried on some experiments in co-operation with the Bureau of Plant Industry, United States Department of Agriculture, as to the adaptability of various hybrid velvet beans to this soil and climate. We have not yet secured a variety that is entirely satisfactory in regard to the maturing of seed.

Project: Soil Fertility.
Results from the application of raw rock phosphate and lime, and lime and phosphate applied separately to a plot that had a crop of red clover turned under indicated that there was practically no difference in the yield of corn from these plots and the plots that had a crop of red clover turned under without the application of raw rock phosphate or lime.

Project: Pork Production.
By the use of rotations recommended in Circular No. 3, pork is produced on a profitable basis. Hogs that have grazed corn and cow peas, soy beans, and sweet potatoes, then fed for ten days on corn, have been pronounced "hard" hogs by the packer.

Project: Kudzu.
We have grown kudzu on this station for about five years and find that it takes about three years for the crop to become well established. After that time it makes rapid growth. It does not give much promise as a hay crop because of the difficulty in harvesting, but it gives good results as a grazing crop.

Project: Para Grass.
This grass has been tried out for the past several years and has finally been discarded as being of no practical value.

Project: Rhodes Grass.
Rhodes grass has been tried out for several years and has been found inferior to other grasses which are already established.

During the year the station purchased two grades of Percheron mares from Tennessee for farm work and for breeding purposes. During the years these mares have worked about eight months, and they have each raised a mule colt.
The work of the Department of Plant Pathology during 1915 has been a continuation of the projects which have been under investigation for several years. This includes a careful study of a number of the most serious of our crop diseases. In Louisiana, plant diseases are particularly important on account of the mild winters, the heavy rainfall and high humidity. The work has included a study of the organisms causing the diseases, the effect on host plants, a careful consideration of climatic factors on development and a study of the possible methods of control. The projects which are under investigation and a summary of the results obtained during the past year follow:

**BEAN DISEASES.**

Project: Life history of the organisms causing the bean anthracnose and bean blight diseases, reaction to environmental and climatic factors such as temperature, methods of control, etc.

Two phases of the bean anthracnose problem have been considered in 1915, these being the effect of high temperature on the fungus and the question of varietal susceptibility. As in previous years, our experiments have shown that the bean anthracnose will not tolerate continued high temperature. The optimum temperature for growth was found to be between 21 and 23 C, and the maximum temperature at which growth would take place was 30 or 31 C. These are comparatively low and explain why the disease will not develop in Louisiana during the summer months. The results obtained have already been published in Phytopathology.

The work on varietal susceptibility has borne out the results obtained by Barrus. The cultures which have been used in the experimental work showed considerable difference in regard to their ability to infect different bean varieties. The results obtained will soon be published in a bulletin.

The project on bean diseases has been discontinued for the present and unless something unforeseen develops, it will not receive attention during 1916.
COTTON BOLL ROTS.

Project: Life history of the organisms causing the rot of cotton bolls, methods of dissemination, means of control, etc.

While there are several organisms causing rot of cotton bolls, only the one causing the anthracnose, Glomerella gossypii has been under investigation in 1915. Some data on the effect of temperature on the development of the fungus was obtained and published. Also some experiments on varietal resistance were continued from previous years. Results from three years work on varietal resistance, show that varieties do not show any very marked difference in regard to their susceptibility to the anthracnose. These results are in press and will soon be published in bulletin form. The cotton boll rot has also been discontinued and will not receive attention during 1916.

SUGAR CANE DISEASES.

Project: Life history of the organisms causing the various diseases of sugar cane including the red rot, rind disease, root rot, stem rot, and the rots of planted cane.

Considerable attention has been paid to the effects of various organisms on planted cane in regard to germination. The poor germination of cane constitutes one of the greatest losses in the sugar industry in Louisiana as it necessitates the planting of a considerable percentage of the crop raised. Several organisms besides insects and certain physiological factors, are concerned in this poor germination. Plots have been planted at Audubon Park for several years with cane inoculated with several of the rot organisms. The results obtained in 1915 agree with those of previous years, showing a poor germination with cane inoculated with the red rot fungus.

TOMATO WILT.

Project: Life history of the organism causing tomato wilt, methods of dissemination, means of control, etc. Also the possibility of obtaining wilt resistant strains and the best methods of selection for obtaining them.

In 1915 a considerable number of cultures of the fungus have been tested out in order to see if the different ones would show a
varying amount of virulence and also to see if there are different strains which react differently with the various tomato varieties. Some strains were very virulent while others were weak, but no evidence was obtained to show that any of the strains had become specialized on some variety or varieties and would not infect others. Many selections for wilt resistance have also been made. A new method of seed bed selection has been worked out which promises to give good results in the selection work. It is possible to select plants in the seed beds and thus save a great deal of labor and garden space. Selection work with some hybrid tomatoes has also been continued in the field.

COTTON WILT.

Project: Life history of the organisms causing cotton wilt, methods of dissemination, means of control, comparison with the other wilt diseases, selection for wilt resistance.

Work on this project during 1915 has been a continuation of the selection work that has been carried on for several years.

EGGPLANT BLIGHT.

Project: Life history of the organism causing eggplant blight and rot, methods of dissemination, comparison of different strains, means of control.

The pathogenicity of a large number of different cultures has been studied during 1915. This has seemed necessary as the cultures show a wide range of variability. Many interesting facts such as the presence of the fungus within the seeds have been determined.

SCLEROTIUM WILT DISEASE.

Project: Life history of the organism causing the disease, effect on various hosts, means of control, etc.

Very little work was attempted on this problem in 1915. Observations on new host plants and severity of the disease were made but no experiments were conducted.
ALFALFA DISEASES.

Project: A study of the factors which limit alfalfa production in Louisiana, including drainage, soil acidity, climate, inoculation and diseases, also the life history of the disease causing the crown rot.

As in previous years, alfalfa plots have been grown to determine the effect of lime, drainage, inoculation, fertilization, etc., but the plants practically all died during the rainy weather in mid summer. Peruvian alfalfa was planted in the plots in the fall.

COTTONSEED MEAL POISONING.

Project: Study of the toxicity of cottonseed meal, effect of different treatments such as heating, boiling, soaking with different solvents, etc., on the toxicity of the meal; comparison of different meals and seeds in regard to the toxic principle.

This project is carried on in co-operation with the Department of Animal Pathology and practically all the work is being done by the animal pathologist, an outline of which is given in his report.

PUBLICATIONS DURING 1915.


HORTICULTURAL DEPARTMENT

Geo. L. Tiebout.

The time of the horticulturist is equally divided between truck extension work and experiment station activities. Investigations and demonstrations in the production and marketing of new truck crops have been continued. Brussells sprouts, winter cauliflower, broccoli, and bell peppers have received special attention in a commercial way.

Project 1. Production and marketing of Brussells sprouts.

Brussells sprouts are a new truck crop which we are investigating with the hope of establishing them as a new winter truck
crop. We feel that our investigations in the culture and marketing of this crop have progressed sufficiently to warrant the advocacy of modest planting by truckers in established trucking centers where the Brussels sprouts can be loaded in refrigerator cars with other vegetables, such as cauliflower and bunched crops. The best variety appears to be the Long Island dwarf, from seed on Long Island, New York. The culture is similar to that of winter cauliflower. Harvesting begins in December and lasts through February. After the sprouts are trimmed and graded, they are packed in sugar barrels with crushed ice for shipment by express to distant markets. Hampers with crushed ice are used for nearby markets. The 24-quart berry carrier is the ideal package to use where general refrigeration is available, as sprouts are offered for sale in the retail markets in quart containers. The prices received to date have been very satisfactory and we feel that the crop will be quite remunerative. Details of culture, harvesting and marketing will be given in bulletin form at the end of the present season.

Project 2. Production and Marketing of Cauliflower.

Investigations in the growing, packing and marketing of cauliflower have been continued along the usual lines planned to meet the problems of growers in the commercial production of winter cauliflower. The demonstrations on alluvial land at the Sugar Experiment Station were completely destroyed by the September tornado which also wiped out hundreds of acres among cauliflower growers in Southern Louisiana.

Project 3. Trials of Broccoli as a supplemental winter crop.

Broccoli is a variety of cauliflower that is hardier than the snowball. While the curd or head is not as compact as that of the snowball type, we hope by adopting certain varieties of broccoli to extend the marketing season of winter cauliflower over four to five months instead of two or three, as in the case with the snowball sorts at present. We have imported broccoli seed from England and France during the past year. The various varieties planted in August have not been affected by cold this winter and are making a very luxuriant growth, and it appears that the results will warrant increased attention to this crop.
Project No. 4. Commercial production and marketing of bell peppers.

Activities in the commercial production and shipping of bell peppers as a summer truck crop have been continued. Our findings indicate that bell peppers should be grown in sufficient quantities to load refrigerator cars instead of shipping by local express. During June and July when most of the Louisiana peppers are marketed the weather is frequently very warm even in the North and the peppers arrive in bad condition without refrigeration. In our investigations, peppers loaded in refrigerator cars for Chicago brought remunerative prices at the end of the season after shipments by local express had to be abandoned on account of losses sustained through bad conditions on arrival.

DEPARTMENT OF ANIMAL PATHOLOGY

Harry Morris.

The work in the Department of Animal Pathology has been continued along the same lines as in previous years. Some of the common animal diseases have been studied and the work has been strictly research.

ANTHRAX.

Anthrax or charbon is one of the most common diseases of live stock in certain sections of the state and usually appears during the warm months of summer. In past years a general study of the disease has been made and some of the common carriers investigated. During 1915 a special study was made of the blood-sucking insects as carriers or disseminators of the disease. Some of the most common flies and mosquitoes were studied with the following results. By using the interrupted method of feeding anthrax was transmitted from infected guinea pigs to healthy ones through the biting of horn flies. The same results were obtained with some of the larger blood-sucking flies.

Anthrax was transmitted from infected animals to healthy ones through the biting of swamp mosquitoes. Several varieties were tested with equal number of transmissions from each.
In all insects tested the transmissions were mechanical as the microorganisms were carried from the infected host to the healthy animal on the proboscis of the insect.

A great many important points remain to be worked out so the subject will be continued along the same lines during the coming year.

By observing strict sanitary laws and the continued use of commercial vaccines the station has passed another year without the loss of a single animal from anthrax. Although anthrax has appeared annually on adjoining farms, the station has not lost an animal from the disease during the past four years.

Bulletin 152 on Anthrax or Charbon was published during 1915.

COTTONSEED MEAL POISONING.

The study of the problem of cottonseed meal poisoning has been continued. Methods for the reduction of toxicity of the meal have been studied. There is a great variation in the toxicity of cottonseed meal and some difficulty was experienced in obtaining meal of sufficient toxicity to produce poisoning in hogs.

In one test twenty hogs were fed large quantities of meal daily for a period of more than one hundred days. They made good gains in weight but showed no symptoms of poisoning. This problem will be continued during the coming year.

DEPARTMENT OF ENTOMOLOGY

Project No. 1. Investigations in Insects Causing Damage to Stored Rice.

The nursery inspection work and the special calls on the time of the Entomologist, occasioned by the spread of the citrus canker disease has prevented uninterrupted prosecution of all entomological problems. However, Mr. E. S. Tucker, associate entomologist, has been able to devote a portion of his time to this work, and to prevent too much interruption of the progress of the observations planned, Mr. Ed Foster was employed for approximately one-half of his time to carry on investigations in New Orleans and at the Sugar Experiment Station at Audubon Park.
The September storm destroyed a considerable portion of the material under observation and interrupted some of the breeding work; otherwise, satisfactory progress has been made on this line of investigation considering the amount of time and money spent on it.

Project No. 2. Corn Root Worm Investigation.

Very little progress has been made in the study of the points of interest on the life history, parasites, or conditions influencing the development of this very serious corn pest. The damage in regions near the experiment station was slight and no good opportunities were offered for any extended observations.

MECHANICAL ENGINEERING DEPARTMENT

E. W. Kerr.

BAGASSE EXPERIMENTS.

During the first part of the year, the results of boiler tests, etc., were worked up and tabulated. These tests were made during the 1914 season at Adeline, Vermilion and Angola sugar factories. A paper entitled “Bagasse Burning” read by the writer before the Louisiana Planters’ Association, April, 1915, embodied the principal results of these tests. Special flue gas analyses were made at Adeline in December for the purpose of determining to what extent, if any, there is in distillation instead of combustion in bagasse furnaces, also the conditions necessary to prevent distillation.

EVAPORATOR EXPERIMENTS.

Under this head three lines of experiments have been carried on during the past season:

1. Test of quadruple effect, vacuum pans and juice heater (made over) at Adeline for the purpose of completing heat balance work done in previous years.

2. Heating juice with vapors from different bodies of evaporators. A single tube heater was constructed during the summer and operated in connection with the single effect evaporator in the laboratory. Tests were made on this heater to determine the effect of juice velocity, density of vapors, and air in vapors on
heat transmission. Vapor heaters were also installed in connection with each body of the double effect at Audubon Park. Tests were made on this apparatus to determine the effect of juice velocity, vapor density and method of venting the steam compartment of the heaters on heat transmission. Other tests were made on the full sized juice heater using vapors from the first body of a quadruple effect at Central Florida, Cuba.

3. Air in Condensers: Tests were made at Adeline and Stirling factories to determine the quantity of air and other incondensible gases handled by the condensers and air pumps. In these tests, such data as would make possible the calculations of the partial pressures of steam and air in the vapor pipes from evaporators and vacuum pans, also in suction pipes to vacuum pumps, including temperatures and pressures, were taken. Data of a similar nature was secured at Florida from a new type of condensing apparatus using rotary air pumps.

Many of the results obtained in the work outlined above have been given in articles printed in El Mundo, The Louisiana Planter and Sugar Manufacturer.

STATION No. 3, NORTH LOUISIANA STATION
J. B. Garrett, Assistant Director.

The work of this station during the past year has been conducted along the same general lines that have been followed for several years under the following main projects:

Project. Three year rotation experiment.

This experiment was originally planned in 1889 and continued without modification until 1908, when the plots were subdivided so as to give half of each plot the benefit of additional compost and commercial fertilizer previously added to the fertilizer plots, and to allow half the fertilizer plots to lapse to the same condition as originally planned for the unfertilized plots, with the general result that the yields in areas receiving compost have rapidly increased and the area to which compost had been added from 1889 to 1908 are showing evidence of rapid depletion of the accumulated fertilizer during that time.

Project. Raw rock phosphate test, as compared to acid phosphate in a three year rotation.
In this experiment, one-third of a field is devoted to corn and cow peas, one-third to crimson clover followed by velvet beans, and one-third to cotton. The velvet beans are turned under in the fall with rock phosphate at the rate of 2,700 pounds per acre once in three years. This application is made on one-half of each area, and 300 pounds of acid phosphate is applied to the corn and cotton crops in the rotation. The general result has indicated that the rock phosphate with the velvet bean crop is slightly inferior to acid phosphate in the production of both corn and cotton.

Project. Variety tests of corn.

Of the twenty selected varieties of corn for test the past year, the results have again shown that the southern strains of corn are superior to all others, and those standing at the top of the list are varieties that have been selected for a number of years in Louisiana, emphasizing again the value of giving attention to the development of our local varieties of corn.

Project. Cotton variety tests.

Of the twenty-four varieties of cotton carried in this test all of the largest yielding varieties are among the fairly well known ones that are raised in North Louisiana by the farmers. A few new varieties extensively advertised have given very poor results.

Projects. Thinning cotton to different stands, and at different times.

Since the issuance of a bulletin by Dr. O. F. Cook of the Bureau of Plant Industry, U. S. Dept. of Agriculture, advocating a method and time of thinning cotton radically different from that commonly practiced in Louisiana, the station undertook a series of experiments to test out the ideas advocated by Dr. Cook. Forty-two experiments were carefully conducted, with the general result indicating that the time of thinning and the stand usually left on the fields at the Experiment Stations have given better results uniformly than cotton raised under the method given by the bulletin referred to above.

Project. Cotton fertilizer experiments.

While there have been some variations in the results of fertilizer tests, there has been less variation during the past year than is usually found in such work. Results have again emphasized the value of fertilizers bearing moderate quantities of nitrogen for cotton in the North Louisiana soils.
Project. Corn fertilizer experiments.

Thirty-nine tests were made of fertilizers of different composition and amounts applied, results generally indicating that cottonseed meal and acid phosphate continue to furnish our cheapest fertilizers for corn. Applications of potash fertilizer failed to show any pronounced value from this ingredient.

Project. Fertilizers for Spanish peanuts.

Twenty-nine tests were made in application of fertilizers to Spanish peanuts. As in previous years, we have failed to get any positive evidence that the peanut crop was benefited by the addition of as much as four hundred pounds of commercial fertilizer per acre; neither does the application of lime seem to materially increase the yield of Spanish peanuts on the soils of the Experiment Station.

Project. Fertilizers for Sudan grass.

This crop showed very marked response to the application of cottonseed meal, and cottonseed meal with the addition of acid phosphate, the largest yields being made with 315 pounds of equal parts cottonseed meal and acid phosphate. This amount of fertilizer trebled the yield over the plots having no fertilizer.

Project. Test of varieties of sweet potatoes.

The past year was especially favorable to sweet potatoes, the yield running over 300 bushels per acre from several of the varieties in the test, the Dooly Yam, Jersey Yellow and Southern Queen ranking among the highest yielding varieties.

Project. Test of fertilizer for sweet potatoes.

Twelve experiments in the application of various fertilizers to sweet potatoes again failed to show any very uniform results in the returns of fertilizers of different composition or of amounts, indicating that there are a number of variable factors that are not yet understood in the application of fertilizers to sweet potatoes.

Project. Cow pea variety tests.

Of the eighteen varieties of cow peas selected for comparative tests, including standard varieties and new introductions, none have been found that are superior to the comparatively well known varieties, particularly the Whippoorwill, the Groit, the New Era, and Brabham, which stand among the highest in our tests.
Project. Soybean variety tests.

Of fourteen varieties of soybeans under trial, the yields varied from a little over three bushels to 20½ bushels per acre, the latter record being reached by the Hollybrook.

Project. Silage and soiling crop tests.

Of thirteen crops selected as being suitable for the production of silage, by far the heaviest tonnage was secured from the rank growing sorghums, particularly the Honey sorghum. The maximum yield secured being a little over 34 tons per acre on good red sandy loam soil, fertilized with 200 pounds of cottonseed meal and acid phosphate per acre.

Project. Pork production.

The past year has given us the largest return from the field crops grazed by hogs that we have ever secured. Corn and peas yielding 541 pounds per acre; Spanish peanuts, 408 pounds per acre; sweet potatoes, 898 pounds per acre. These results are part of a record secured in following out the rotations recommended in Circular No. 3.

Project. The growing and feeding of beef cattle.

During the past year a hundred ton stave silo was erected and filled with silage, mostly corn and soybeans, which has been used for wintering the cows and calves in our beef production experiments. With a moderate amount of silage we have been able to keep animals in first class condition at a comparatively small cost.

Project. The storage of sweet potatoes.

The sweet potato storage house is in operation again this year, where about 400 bushels of potatoes are properly housed. For the past two years this house has enabled us to keep sweet potatoes in good condition with very small loss. In the spring of 1915 we disposed of the 1914 crop at $1.00 per bushel and found a ready market for them.

HORTICULTURAL WORK.

The horticultural work has included a continuation of a large number of variety tests, fertilizer applications, production of seedling peaches, etc. Only the more important things need to be mentioned.

Four of the varieties of grapes to which a quarter acre had been planted gave a fairly good market crop the past year. They
found a ready sale at Monroe and Shreveport at 4 cents to 5 cents per pound. The yield of these four varieties ranged from 1280 pounds to 1644 pounds per acre. Of the 70 varieties under test at the vineyard a number have produced yields at the rate of 3,000 or more pounds per acre, the Catawba giving a yield of 5,655 pounds.

Of the seedling peaches, three or four seedlings have been found that are worthy of propagation, and one that seems to have special merit. Samples of this seedling were sent to the pomologist of the U. S. Dept. of Agriculture at Washington the past season, and pronounced there as being of good quality and worthy of propagation. It is a vigorous growing peach of the Elberta type, and if the tree proves to be a durable one, it will probably be a valuable accession to North Louisiana.

The experiments previously outlined on the Magnolia fig have been practically a complete failure, as we have been unable to overcome the difficulties that seem to stand in the way of making this a commercial fig in that portion of the state.

The variety tests of Irish potatoes, and hill selections, have only confirmed results already published in bulletin form.

STATION NO. 4, RICE EXPERIMENT STATION
Crowley.

F. C. Quereau, Assistant Director.

This station is conducted as a joint enterprise between Louisiana State University and the United States Department of Agriculture.

All of the experiments outlined in previous reports have been continued.

PHOSPHORUS EXPERIMENTS.

It may be stated in a general way that the soils in that section are in need of some form of phosphorus for the best development of rice and that under ordinary circumstances a high grade acid phosphate is most apt to meet this requirement. Two hundred pounds per acre is approximately the most favorable quantity to be used. For five years in succession this amount has produced the most profitable crops. A serious difficulty, however, to
be contended in continuous cropping is that the application of acid phosphate accelerates growth of grasses and weeds until these field pests become a menace to the crop. However, it emphasizes the necessity for some form of rotation that will help keep these weeds suppressed. On all of the experiments where phosphate has been used as a fertilizer, the application had been made broadcast. There is some evidence that if phosphorus were applied in the drill the difficulty encountered with weeds and grasses would be somewhat diminished. However, this is yet to be more fully tested before any conclusions are reached.

*The potash experiments* do not yet indicate that the yield of rice is appreciably increased by the application of potash salts. As we have not yet been able to construct a small rice mill for milling tests, we are still unable to determine with positiveness what may be the effect on the milling quality of rice resulting from the application of potash.

*In the nitrogen experiments*, it seems evident that readily available forms of nitrogen are superior to organic forms of nitrogen when applied to Honduras rice, but the results are not conspicuously different when different forms of nitrogen are used on the late maturing varieties.

*Straight Head in Rice.* This disease or condition seems to occur in land containing an abundance of vegetable matter. Rice grown on land previously planted to some highland crop is most likely to be affected. It is not definitely known whether this is caused by a disease or is due to certain physical conditions caused by the decay of vegetable matter in the soil under flooding conditions. The only known preventive is to delay initial irrigation as long as possible, or, if it is necessary to irrigate because of weeds or grass, to drain about fifteen days from the time of first flooding and allow the land to become dry. This in the greater number of cases seems to largely prevent "straight head" condition.

*Root Maggot* (*Lissorphopterus symplex*). Experiments seem to indicate that from 15 to 30 gallons of crude oil per acre applied to the irrigation water when the rice is first flooded will in a large measure prevent the work of the maggot.

*Crop Rotations.* There are two two-year rotations, one three-year rotation and one four-year rotation. All rotations commenced in 1910 have been continued.
In 1915 the rice yield on these plots averaged 17.6 barrels per acre, the corn (injured by July storm), 12 bushels; oats, 30 bushels. The check plot planted continuously in rice made 2.18 barrels per acre of pure red rice. It is believed that rotations which include rice and highland crops should be as long as possible. In these experiments (with fertilizers on rice) five profitable crops of rice have been grown in succession on land which was considered "worn out." It, therefore, seems reasonable to believe that six or seven crops of rice might be grown on land that is in a high state of fertility due to the growing of highland crops in long rotation. By means of long rotation, therefore, the overhead expense of levees in the one case and drainage ditches on the other would be met.

Miscellaneous Crops. The usual number of crops were grown on the station during 1915.

A Mungo bean seems to be a plant of considerable promise. This bean made a heavier growth of vine than any other legume grown on the station. However, the yield of grain was small. Further experiments will be conducted with it during 1916.

Garlic is also a crop which seems to do very well on rice soils.

Japanese cane was grown for the first time. The yield was small, due to prolonged drought. It is believed, however, to be a very promising crop for the rice farm.

The United States Department of Agriculture has been devoting primary attention to the introduction of new varieties of rice secured from different parts of the world for trial here. They have secured some strains that are undoubtedly superior in some respects to any strains previously grown in Louisiana, and it is likely that some of these will have a combination of desirable characters that will make them popular throughout the state. Small quantities of a number of these most promising strains have been distributed to rice planters throughout the state for field trials. Mr. C. E. Chambliss and Mr. J. M. Jenkins, who have charge of this work for the Department, have now collected something like twenty-five hundred varieties of rices from all parts of the world, and are making a thoroughly technical study of them, as well as testing their adaptability to conditions in Louisiana. A full report of their work will be issued in due time by the United States Department of Agriculture.