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# First Annual Report of Vivian Experiment and Demonstration Farm

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Manley Champlin

J.G. Hutton

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# AGRICULTURAL EXPERIMENT STATION

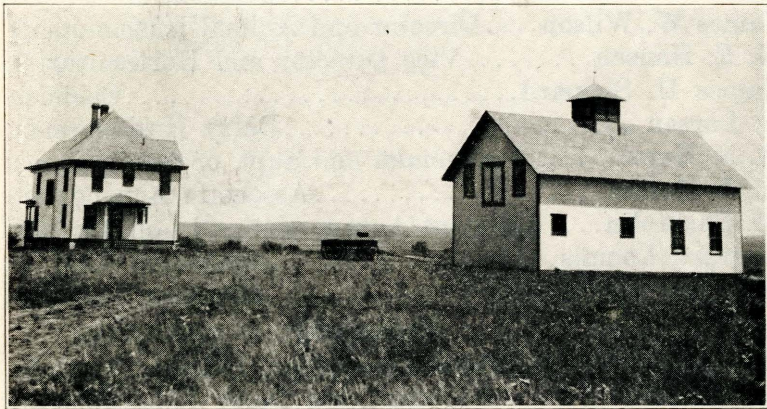
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SOUTH DAKOTA  
STATE COLLEGE OF AGRICULTURE  
AND MECHANIC ARTS

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AGRONOMY DEPARTMENT

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FIRST ANNUAL REPORT  
OF  
VIVIAN  
EXPERIMENT AND DEMONSTRATION FARM

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BROOKINGS, SOUTH DAKOTA

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BOWEN PUBLISHING COMPANY. HURON. S. D.

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Location of Substations:

Highmore ..... Hyde County  
Eureka .....McPherson County  
Cottonwood ..... Jackson County  
Vivian .....Lyman County

## FIRST ANNUAL REPORT OF VIVIAN EXPERIMENT AND DEMONSTRATION FARM.

By A. N. Hume, Manley Champlin, and J. G. Hutton.

The present report, has for one of its purposes, the fulfilling of the legal requirement which provides that a report shall be made of the work of the Vivian Farm. It is therefore a narrative of events and observations rather than any attempt to draw final conclusions therefrom. It is assumed that results given in the present report will later be used in Experiment Station bulletins dealing with specific subjects, and more completely analyzed in the light of further results from Vivian and other points. Such results will be published under the department of the South Dakota Experiment Station within which they naturally fall.

Work here reported is chiefly agronomy, planned and reported under the criticism of the divisions of Soils and Crops. The present report is largely as compiled and presented by Manley Champlin.

Acknowledgment is here made of the services of Mr. E. J. Nelson, Foreman of Vivian Farm.

### FOUNDING OF THE FARM.

An act was passed by the legislature of 1911 establishing what was designated as the Vivian Experimental and Demonstration Farm, making it a branch of the South Dakota State College and Experiment Station. Its purpose was stated to be to demonstrate the most approved methods of agriculture under central South Dakota conditions and incidentally to do some experimental work. No appropriation was made at this time with which to begin work. The 1913 legislature carried this law into effect by the following act to be found in the Session Laws of 1913, Chap. 86, H. B. 136:

## APPROPRIATION FOR EXPERIMENTAL FARM AT VIVIAN.

AN ACT Entitled, An Act to Appropriate Money for Buildings, Equipment, Stock and Operating Expenses for the Experimental and Demonstration Farm at Vivian, South Dakota.

Be it Enacted by the Legislature of the State of South Dakota:

1. There is hereby appropriated out of the general funds of the state not otherwise appropriated, the sum of Eleven Thousand Dollars (\$11,000.00) to be available as follows:

For the year 1913 the sum of Eight Thousand Dollars, (\$8,000.00).

For the year 1914 the sum of Three Thousand Dollars, \$(3,000.00), or so much thereof as may be necessary. The same to be used according to the provisions of Chapter 127, Session Laws of 1911, in the construction of suitable and necessary buildings and improvements, for purchase of necessary tools and machinery, farm and dairy animals and equipments, including a silo, seed and necessary expense, including help and labor in conducting the experimental and demonstration farm at Vivian, Lyman County, South Dakota.

The amount to be expended for different items shall be in the discretion of and under the management and supervision of the Board of Regents of Education.

2. The state auditor shall issue warrants upon the state treasury to pay expenditures under the provisions of this act on proper vouchers furnished by the Board of Regents of Education.

3. An emergency is hereby declared to exist and this act shall take effect and be in full force from and after its passage and approval.

Approved March 13, 1913.

On April 28, 1913, the Milwaukee Townsite Company deeded certain lots to the state upon condition that the same be used for experimental or demonstration purposes. These lots adjoin the town of Vivian proper on the north, the east and the southeast sides

and form a part of the town site, comprising an area of 170.69 acres.

During the summer of 1913 the first field of 43.76 acres was plowed. This field has been named, the north-east field.

During the winter of 1913 and 1914 a house and barn were erected.

The machinery needed immediately and one team of horses were purchased and help was hired by the day to put in the crop and build a fence around the tilled portion. When the appropriation for the second year became available, more machinery was purchased, a silo was erected and a good fence was put up around the south section of the farm.

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#### A FARMING SYSTEM.

The soil of the Vivian farm is classified as Pierre clay. This type of soil is made up of clay and fine sand with cementing or colloidal material. Such soil is retentive of moisture and usually rich in mineral fertility but lacking in organic fertility and consequently difficult to till, being hard and lumpy when dry and sticky when wet.

The climate is typical of the central part of the state. Frequent and rapid changes in temperature, a light and varying summer rainfall and very little snow characterize this climate. A weather observatory for determining the rainfall and the temperature changes was established on the farm in cooperation with the Weather Bureau of the United States Department of Agriculture, during the summer, but these observations have not been continued long enough to be of value at this time. From data furnished by the Weather Bureau based on observations at other points in this area, it can be said that the average rainfall at Vivian is probably about 17 inches with an annual range of from 9 to 25 inches.

During the present season, the rainfall has been above normal and its distribution through the growing

season has been quite satisfactory. For this reason the yields reported may not be considered indicative of what may be obtained as an average for a long period of years in this area. It is known from experiments at Cottonwood that seasons may occur in this area when the yields obtained will return but a fraction of the cost of production.

For these reasons, a system of farming was planned with the idea in mind:

1. To raise stock feed.
2. To enrich the soil in organic matter and thus improve its physical condition.
3. To conserve as much moisture as possible by cultivation.
4. To grow a perennial leguminous crop, alfalfa, increasing the acreage as rapidly as possible.

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#### AN ALFALFA BORDER.

The field was divided into three equal parts from north to south with fourteen acres in each division. This left a margin 1.64 rods wide and 171.5 rods long, containing 1.76 acres of land. This margin has been prepared for alfalfa. An alfalfa border utilizing the waste spaces, serving as a turn row, when cultivating or harvesting the other crops is not only good to look at but may be worth while as a profit producer. It is believed that many farms throughout the state could utilize this alfalfa border idea to good advantage.

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#### A PRACTICAL ROTATION.

The field was again divided from east to west into seven equal parts containing six acres each. The southernmost of these fields was again divided into two equal parts. Thus the forty-two acre field was divided into twenty-four parts. The subdivisions of this field were made for the purpose of experimenting to answer the following questions:

1. Is it preferable to break new land shallow or deep?

2. What influence does time of breaking have on the following crop?

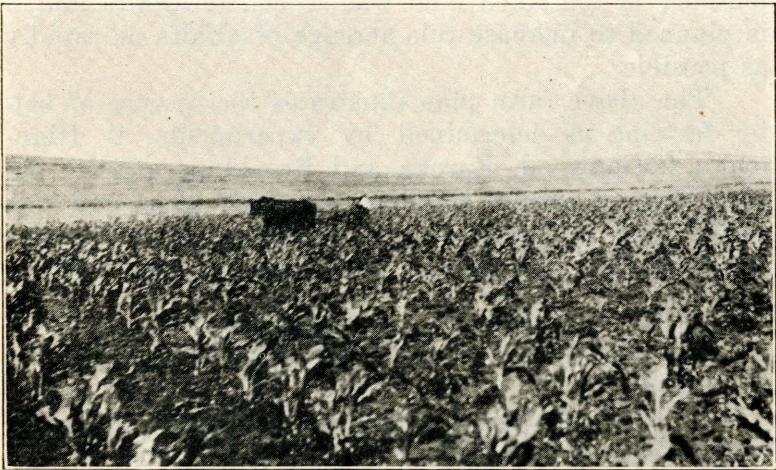
3. Is corn as profitable as kaoliang?

4. Should oats be sown in three row groups thirty inches apart and cultivated or by the ordinary method of drilling with the drill rows six inches apart?

5. When oats are used as a nurse crop for sweet clover, is it more profitable to make them into hay or to allow them to mature a grain crop?

6. Should alfalfa be seeded with or without a nurse crop?

This experimental work necessarily increased the actual cost of production, but it served to throw considerable light on the problems undertaken and was considered well worth while. It is not recommended that a farmer in this section go to the trouble and expense of trying out these different methods but rather that he should watch the results by visiting the farm and by reading the reports from time to time and adopt the methods that give the best results.



Three row method for moisture conservation. Note the native vegetation.



The rotation followed is known to be a good one because it contains the essential elements of a good rotation. It consists of:

1. Corn and kaoliang, checked and cross-cultivated.
2. Oats, half-drilled solid and half-seeded by the new three-row group method devised by this department.
3. Sweet clover drilled in rows three feet apart shortly after seeding the oats, to be cultivated in its second year or in case of failure of the sweet clover to be sown to a mixture of oats and peas for hay. This method of planting the sweet clover may be varied as experience dictates.

Thus the rotation will occupy three years' time. Half of it may be cultivated all three years and is certain to be cultivated two years out of three. The other half may be cultivated but one year in three.

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#### ALFALFA GRADUALLY INCREASED.

In addition to the above rotation scheme all the remainder of the tilled land was seeded to alfalfa and it is planned to increase this acreage of alfalfa as rapidly as possible.

The above farm plan illustrates the essence of better farming as determined by experiments at Highmore, Cottonwood, Eureka and Brookings and by observations of careful thinkers who have pioneered this section and are succeeding in producing more feed for livestock than was possible under the old range system.

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#### ADVANTAGES OF THIS SYSTEM.

The advantages of this system are assumed to be as follows:

1. The cultivation conserves moisture and keeps the land free from weeds or plants not wanted.
2. Corn is a very dependable crop especially for silage purposes.
3. Kaoliang is the most drouth resistant crop for

South Dakota conditions yet discovered and can be used either as a grain or fodder crop or both.

4. Oats are excellent as a grain feed to keep the work horses in good condition and make valuable hay in case of failure to make grain.

5. Sweet clover is a vigorous crop of the legume group and can therefore appropriate nitrogen from the air. It is a biennial and is therefore well adapted to a good rotation system. Its roots are vigorous and improve the physical condition of the soil by penetrating it to a depth of two feet or more and branching freely.

Further, the growing of sweet clover for seed promises to be very profitable owing to the ever increasing demand for this crop. See South Dakota Bulletin 151. Planted in rows, as it is in this system of farming, it permits further cultivation of the soil and its resulting benefits. In case of failure of the sweet clover to make a stand the land is to be seeded early in the spring to oats and peas, a quick growing hay crop, which is removed early so that the land may be plowed and fallowed the remainder of the season.

6. Alfalfa is a perennial legume with ability to utilize atmospheric nitrogen and improve the condition of the soil by the action of its roots. In addition to this it is capable of making a hay crop with great rapidity when moisture is plentiful and of lying nearly dormant when moisture is deficient. The hay, being rich in protein, helps to make a balanced ration when fed to livestock in connection with silage or fodder. For these reasons, it is well to increase the acreage of alfalfa as rapidly as it is found to be practicable.

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#### SOIL PREPARATION.

In order to study the effect of the depth of breaking on the yield of the following crop, one-third of the entire field was broken about six inches deep. Another third was broken about three inches deep. Both of these portions were double disked by lapping half before breaking. The third portion was broken three

inches deep without the preliminary disking. The entire field was double disked and double harrowed immediately after breaking. The land broken each day was double disked and harrowed the same day in order to put the field in good seedbed condition. In the spring it was found necessary to double disk and double harrow the entire field again. The cost of this labor per acre was as follows:

Breaking 3 inches . . . . .	\$ 4.00
Breaking 6 inches . . . . .	5.50
Double Disking . . . . .	1.00
Double Harrowing . . . . .	.40

While the cost of subduing the land and bringing it to a condition of good tilth was rather high, it was thought to be worth while, as it might make it possible to produce good crops on the land the year immediately following.

In the future, the annual cost of soil preparation will be materially reduced because of the systematic rotation of crops. The land for corn and kaoliang will be plowed six to eight inches deep in the fall, dragged twice and double disked in the spring. The first harrowing will be given it as soon as the land can be worked in the spring. The double disking will follow in time to destroy the first weed growth. The second harrowing will be done immediately preceding the planting of the corn or kaoliang. The oats and sweet clover will follow the corn and kaoliang. The land will be double disked, double harrowed and seeded as early in the spring as possible. The sweet clover will follow the oats without any further preparation of the soil. Thus only one-third of the land will need to be plowed each year.

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#### RESULTS FOR 1914.

The results for 1914 apparently favor:

1. Six inch rather than three inch breaking.
2. Early rather than late breaking.
3. Breaking without prior double disking.

4. Seeding alfalfa with a light nurse crop of Sixty Day S. D. 165 oats rather than without a nurse crop.

There was little difference between the value per acre of corn, Highmore 13 and Manchu Brown Kaoliang S. D. 290. Oats sown by the usual method were superior in yield to oats sown in three row groups thirty inches apart and cultivated. Oat hay was not as valuable as oat grain.

The present season was favorable. The above results for one year should be taken for what they are worth, but should be considered carefully and conclusions should not be made too hurriedly. For example, experiments covering several years at Highmore and Cottonwood show kaoliang to give a greater value per acre than corn as an average of favorable and unfavorable seasons, and also that oats grown by the row system give higher yields in unfavorable seasons than when sown by the ordinary method.

On the other hand, early breaking, reasonably deep breaking and a light nurse crop of early grain with alfalfa seeding are all known to be good farm practices at other points, so that the one year's results at Vivian in regard to these matters agree with previous observations.

Table I. shows the results obtained on three inch breaking done in September, 1913, as compared with crops grown on six inch breaking done in August. The six inch breaking cost (\$1.50) one dollar and fifty cents more per acre than the three inch. In the case of all crops grown in this comparison, except the kaoliang seed and the straw from oats grown in rows, there was a distinct gain in crop yield, in favor of the deeper, earlier breaking. Assuming the kaoliang seed to be worth eighty cents per bushel; seed corn two dollars per bushel; silage three dollars per ton; oat straw, two dollars per ton; oat grain, fifty cents per bushel and oat hay five dollars per ton, this average gross gain per acre was \$4.88 or a net gain of \$3.38 in favor of the six

inch, earlier breaking as compared with shallow breaking.

TABLE I.  
ACRE YIELDS OF CROPS GROWN ON SIX INCH AUGUST  
BREAKING, AS COMPARED WITH YIELDS FROM  
THREE INCH SEPTEMBER BREAKING.

CROP	Variety	S. D. No.	August 6-in. Breaking	September 3-in. Breaking	Difference
Kaoliang (seed).....	Manchu Brown	290	6.1 bu.	6.1 bu.	.0 bu.
Kaoliang (silage)....	Manchu Brown	290	1.375 T.	1. T.	.375 T.
Corn (seed).....	Highmore Minn. 13	86	3.08 bu	.0 bu.	3.08 bu.
Corn (silage).....	Highmore Minn. 13	86	1.338 T.	1.018 T.	.320 T.
Oats in rows (grain).	Select Swedish	112	21.5 bu.	19.9 bu.	1.6 bu.
Oats in rows (straw).	Select Swedish	112	.41 T.	.51 T.	-.1 T.
Oats (grain).....	Select Swedish	112	39.8 bu.	27.50 bu.	12.3 bu.
Oats (straw).....	Select Swedish	112	.78 T.	.51 T.	.27 T.
Oat nurse crop (grain)	Sixty Day	165	33.75 bu.	15.60 bu.	18.15 bu.
Oat nurse crop (straw)	Sixty Day	165	.318 T.	.256 T.	.062 T.
Oat nurse crop (hay)	Sixty Day	165	1.305 T.	.399 T.	.906 T.
Acre cost of soil preparation			\$9.30	\$7.80	\$1.50

TABLE II. gives yields from July breaking, not previously disked and September breaking, that had been previously disked. Here, all of the breaking is the same depth, three inches. One part was done in July and the other in September. The land broken in September received a double disking prior to breaking while that broken in July did not. This increased the cost of the September preparation by one dollar per acre. Otherwise both pieces of land were handled the same. Assuming the same values as heretofore for the crops produced the average gain per acre from the July breaking was \$4.13 after making allowance for the difference of \$1.00 in the cost of soil preparation. It will be noted by an inspection of the table that the largest gains obtained from the early breaking

are to be found in the oat grain yield where not cultivated. This difference may be due to the absorption of moisture by the July breaking in 1913 and to the probability that water was better conserved where growing grass was plowed under.

TABLE II.

ACRE YIELDS OF CROPS FROM JULY THREE INCH BREAKING WITH NO PREVIOUS DISKING AND SEPTEMBER THREE INCH BREAKING DISKED BEFORE PLOWING.

CROP	Variety	S. D. No.	July 3-in. Breaking	September 3-in. Breaking	Difference
Kaoliang (seed).....	Manchu Brown	290	4.9 bu.	6.1 bu.	-1.2 bu.
Kaoliang (silage).....	Manchu Brown	290	1.16 T.	1.0 T.	.16 T.
Corn (seed).....	Highmore Minn. 13	86	1.63 bu.	.0 bu.	1.63 bu.
Corn (silage).....	Highmore Minn. 13	86	1.080 T.	1.018 T.	.062 T.
Oats in rows (grain)....	Swedish Select	112	20.5 bu.	19.9 bu.	.6 bu.
Oats in rows (straw)....	Swedish Select	112	.41 T.	.51 T.	-.10 T.
Oats (grain).....	Swedish Select	112	42. bu.	27.50 bu.	14.50
Oats (straw).....	Swedish Select	112	.946 T.	.51 T.	.436T.
Oats Nurse Crop (grain)	Sixty Day	165	30.25 bu.	15.60 bu.	14.65 bu.
Oats Nurse Crop (straw)	Sixty Day	165	.384 T.	.256 T.	.128T.
Oats Nurse Crop (hay)...	Sixty Day	165	1.094 T.	.399 T.	.695 T.
Acres cost of soil preparation			\$6.50	\$7.80	-\$1.00

Table III. presents a comparison of the yields obtained on land broken six inches in August and on land broken three inches in July. The six inch breaking was double disked before breaking. The three inch breaking was not. The cost of the soil preparation of the six inch breaking exceeded that of the three inch breaking by \$2.50 per acre. While in most cases there was an increase in crop yields, the difference was not large. Assuming the same values as before, the average increase in crop yields per acre from deeper August breaking as compared with shallow July breaking was worth \$1.17. Since the increased cost was \$2.50, the net

actual return per acre was \$1.33 less from the deep than from the shallow breaking.

TABLE III.  
ACRE YIELDS OF CROPS FROM SIX INCH AUGUST BREAKING  
AND THREE INCH JULY BREAKING.

CROP	Variety	S. D. No.	August 6-in. Breaking	July 3-in. Breaking	Difference
Kaoliang (seed).....	Manchü Brown	290	6.1 bu.	4.9 bu.	1.2 bu.
Kaoliang (silage).....	Manchu Brown	290	1.375 T.	1.160 T.	.215 T.
Corn (seed).....	Highmore	86	3.080 bu.	1.63 bu.	1.45 bu.
Corn (silage).....	Minn. 13 Highmore	86	1.338 T.	1.080 T.	.258 T.
Oats in rows (grain).....	Minn. 13 Swedish	112	21.5 bu.	20.5 bu.	1.0 bu.
Oats in rows (straw).....	Select	112	.41 T.	.41 T.	.000 T.
Oats (grain).....	Swedish	112	39.8 bu.	42.00 bu.	2.2 bu.
Oats (straw).....	Select	112	.78 T.	.946 T.	.166 T.
Oat Nurse Crop (grain) ..	Swedish	165	33.75 bu.	30.25 bu.	3.50bu.
Oat Nurse Crop (straw) ..	Sixty Day	165	.318 T.	.384 T.	.066 T.
Oat Nurse Crop (hay) ...	Sixty Day	165	1.305 T.	1.094 T.	.211 T.
Acres cost of soil preparation			\$9.30	\$6.80	\$2.50

#### HOW THE CROPS ARE UTILIZED.

Since using all of the products of the farm to the best advantage is of equal importance with producing them, a plan was followed whereby the entire crop was utilized.

The heavy, compact heads of kaoliang were selected for seed early in September. The desirable ears of corn were selected for seed, after which the entire crop remaining was cut and put into the silo. The value of kaoliang for silage has probably never been tested. The corn and kaoliang were placed in the silo in separate layers, so that an opportunity may be had to feed the two kinds of silage out separately and learn something as to their comparative value as feeds.

The oats were harvested in the usual manner, shocked and threshed near the barn so that the straw is easy

of access for feeding and bedding purposes. The best of the grain will be sold for seed. The oats harvested for hay were stacked carefully and are being used for feed.

All crops not sold for seed are to be fed on the place and the manure returned to the soil ahead of intertilled crops.

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FINANCIAL STATEMENT.

FISCAL YEAR, 1914

July 1, 1913 to July 1, 1914

EXPENSE:

Salary of Superintendent.....	\$ 250.00
Labor, putting in crop.....	265.50
Freight and express .....	50.58
Sundry Supplies and Seeds.....	116.70
Feed .....	44.36
Farm Implements .....	433.48
Horses, 1 Team .....	350.00
Traveling Expenses .....	110.84
Buildings, House and Barn.....	6,389.54
Total.....	\$8,011.00

RECEIPTS:

State Appropriation .....	\$8,000.00
Land Endowment Fund .....	11.00
Milwaukee Townsite Co. 170.69 Acres @ \$10	1,706.90
Total.....	\$9,717.90

INVENTORY, July 1, 1914:

Land; Buildings and Fence.....	\$8,500.00
Farm Implements .....	402.25
Livestock, 1 team of mares and 1 colt.....	350.00
Total.....	\$9,252.25



## FUTURE DEVELOPMENT.

Plans for future development of this project include the following:

1. Continuation of model crop rotation system demonstration.

2. Utilization of margins for permanent alfalfa meadows.

3. Utilization of irregular creek bottom land for pasture to be seeded to alfalfa and sweet clover without plowing.

4. Field demonstrations of the most drouth resistant crops as determined by experiments at Highmore, Cottonwood and other points.

5. Maintenance of a small dairy herd for demonstration purposes. The dairy demonstrations will be such as meet the approval of the department of dairy husbandry of the South Dakota experiment station.

6. Field demonstrations with hardy forest trees and fruit trees such as may be recommended by the department of horticulture.

7. Poultry demonstrations recommended by the department of animal husbandry.

8. Regional service, including help in agricultural meetings, entertainment of visiting farmers, and cooperation where possible along various agricultural lines.

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VISITORS WELCOME.

Visitors are always welcome but especially so on Saturday afternoons. If need be, the station force will abandon all other work on Saturday afternoons for the purpose of entertaining visitors and explaining the nature of the work both experimental and demonstration-al. Visitors need not hesitate to ask for guidance.