7-1-1930

A Decade of Crop Yields from Vivian Farm

A.N. Hume

Bulletin No. 253 July, 1930

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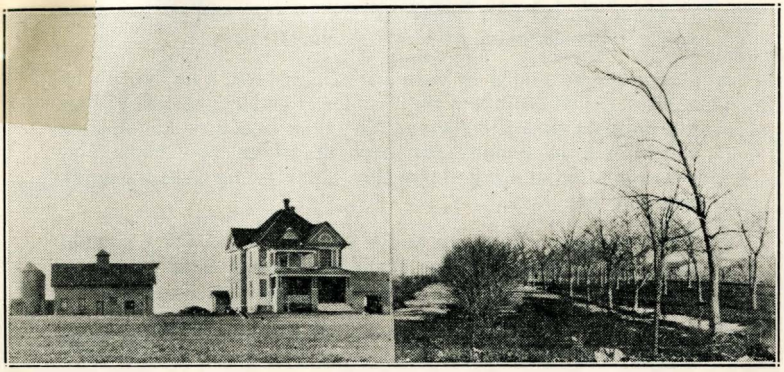

Vivian Experiment Demonstration Farm

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SUMMARY

1. Vivian Experiment Demonstration Farm is located fifty miles west of the Missouri at Chamberlain, on Orman clay (terrace phase) and Pierre Silty clay soil, and is therefore fairly representative of a wide area. Page 4.

2. Comparative yields of corn for silage from two types (1) a flint, called Rainbow flint, and (2) a dent, called Vivian 13, indicate that the former flint type produced the higher total yield in pounds per acre of silage at Vivian. The average yield of silage from that variety was 6130.5 pounds per acre per year.

3. The average yield of silage for ten years was 499.4 pounds per acre per year higher from listed corn than from the average of corn drilled and checked. Table 2, Page 9.

4. The average yield of silage corn for ten years was slightly higher from unmanured land than from land treated with stall manure. Table 3, Page 10.

5. Yields of ear corn, produced for grain are nominal, and may indicate the need for an early growing variety, that will mature in the earlier part of the season when conditions are most favorable for ripening corn intended for grain.

6. Odessa barley has been a more productive crop at Vivian than either Cole oats or winter rye, based on either average pounds per acre, or on reported farm value of such crops. Table 5, Page 15.

7. The average yield of alfalfa hay was lower when it was seeded in winter rye, than when seeded in early oats or barley, indicating that winter rye is not the most desirable nurse crop for alfalfa under the conditions at Vivian. Also the yields were somewhat higher after seeding in Cole oats than after seeding in barley.

INDEX

Vivian Experiment Farm

A Decade of Crop Yields and Some Observations Therefrom

by

A. N. Hume

These pages put down roundly ten years of measured yields from crops produced at the Vivian farm. These yields serve as the best answer to many inquiries which come from farmers and others asking what crops to produce and how to produce them over a wide area. Many questions not directly answered by these data will be clarified by careful study of them. The attempt will be made here to put down facts about farming from which others may build their own opinions about farm practices within the area represented under the conditions prevalent at Vivian.

Location

These farming operations are carried out on 170.69 acres of land closely adjoining the town of Vivian on three sides—south, east and north. This land is located in Township 105-N, Range 79-W, Lyman county, South Dakota. This land was deeded to the state of South Dakota on April 26, 1913, by the Milwaukee Townsite company, the condition being that it be used for experimental or demonstration purposes.

Climatic and Soil Conditions

The soil of the Vivian farm is classified as Orman Clay (terrace phase) and Pierre Silty 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. It is consequently important that tillage operations be carried out at times when the moisture content is at an optimum.

The climate is typical of the central part of the state. Frequent and rapid changes in temperature, varying summer rainfall, and light snow in winter characterize the climate.

Weather observations, including rainfall, are taken at Vivian experiment farm and reported cooperatively to the United States Weather Bureau. Accordingly the records of the station furnish annual and monthly rainfall for the period since its establishment. Page 36.

Cropping Systems

The first new breaking of sod on this farm was carried out in the summer of 1913 when the field named the "northeast field," consisting of 43.67 acres, was plotted. Other breaking was accomplished somewhat later. The earliest observations about farming were based necessarily on general operations carried out on this new land. These operations were reported in an annual report issued in October, 1915 (bulletin 162). Beginning with the season of 1920 it was practicable to lay out some very definite cropping systems. Fields were marked off with metal and cement stakes so that exact measurements of areas could be taken and accord-

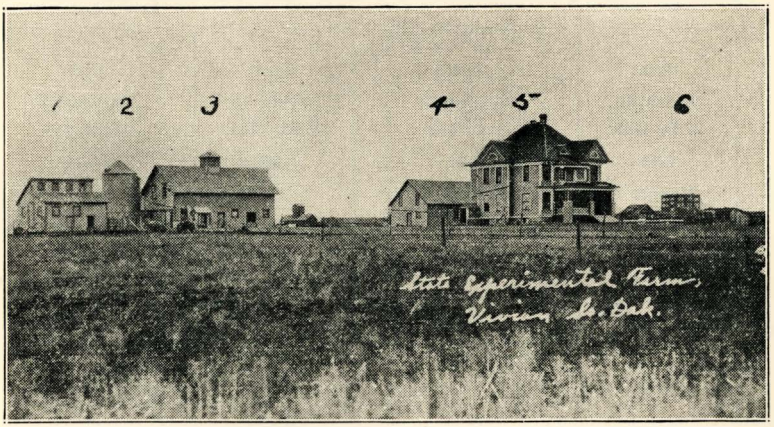


Fig. 1—VIVIAN EXPERIMENT DEMONSTRATION FARM BUILDINGS

1. Hog house. 2. Silo. 3. Dairy barn. 4. Seed house and machine storage. 5. Dwelling. 6. Vivian public school in the distance.

These buildings have been gradually improved since they were originally located on land donated to the state by the Milwaukee Townsite company. The entire plant forms a valuable asset.

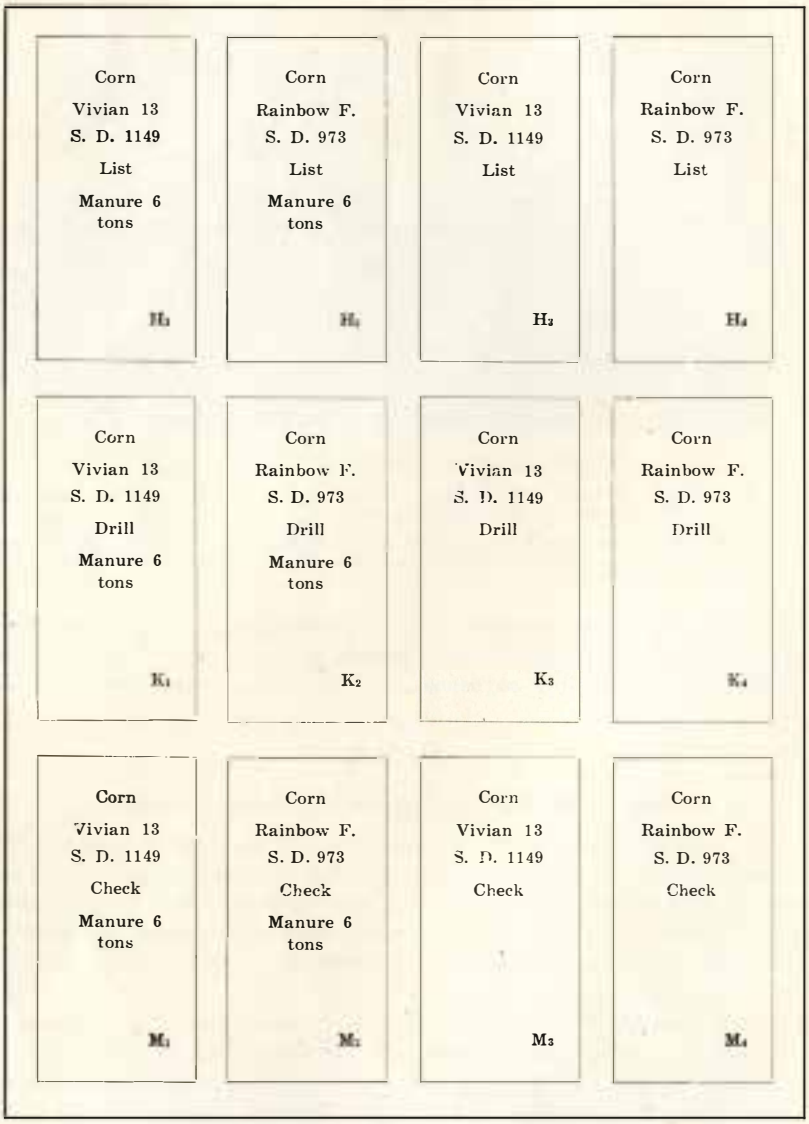
ingly definite yields computed. The crops included in these areas which will also be mentioned later were mainly corn, rye, barley, oats, alfalfa. Special crops including soybeans and sudan grass have been produced from time to time.

CORN

Comparative Tests of Two Corn Varieties for Silage

A field of continuous corn was laid off within the original outlots H and K of Vivian farm. This continuous corn field was divided and staked off into twelve separate permanent acres with corders or turn-rows between the acres two rods wide. The following diagram illustrates the relative positions of the acres of land and likewise states the variety of corn planted in each separate acre.

The locations of these two varieties or types of corn are alternated in successive years in order that soil variations may be equalized over a period of time. This comparison of two types of silage corn has been carried out continuously on the same land without rotation of crops. Obviously yields of six separate acres of Rainbow flint and yields of six separate acres of Vivian 13 are obtained annually. Accordingly the averages of the six separate yields of each variety furnish a more consistent performance record of the comparative varieties than one single year in each case could furnish.



Plat 1—PLAN OF TWELVE CORN ACRES (1927)

(Three Series—H-1, 2, 3, 4; K-1, 2, 3, 4; M-1, 2, 3, 4.)

Comparison of Two Types of Silage (1) Vivian 13 and (2) Rainbow flint.

Harvested for Silage

Two Distinct Corn Types—One Flint; One Dent

One reason for choosing the two varieties of corn mentioned from among the large number of possible varieties was to find if possible **whether a well adapted type of flint corn would be better suited for the conditions of this area than a well adapted variety of dent corn, or vice versa.** It is generally understood that Rainbow flint is fairly representative of the kind of flint corn which branches or shoots freely, makes considerable vegetative growth and which often matures ears and produces grain. Likewise Vivian 13 is dent corn which was introduced into the state of South Dakota under the name of Minnesota 13, later produced for a number of successive generations at Brookings and called there Brookings 86. Vivian 13 in turn was secured from this South Dakota 86 and produced at Vivian for successive years. (See S. D. bulletin 204, page 600.)

Thus the two varieties used in this experiment are not only distinct from one another but representative of two possible types of corn.

Table 1—Average Yields of Silage from Varieties Indicated in Successive Seasons

Year	Rainbow Flint	Vivian 13	Difference in Favor of Rainbow Flint
1928	4572	4727	155
1927	8277	7179	1098
1926	2283	2247	36
1925	2578	2295	283
1924	5868	5298	570
1923	6165	4795*	1370
1922	13593	11100	2493
1921	5224	3825	1399
1920	6957	4916	2041
1919	5788	5244	544
Av.	6130.05	5162.6	967.9

*--(Av. of 2 acres)

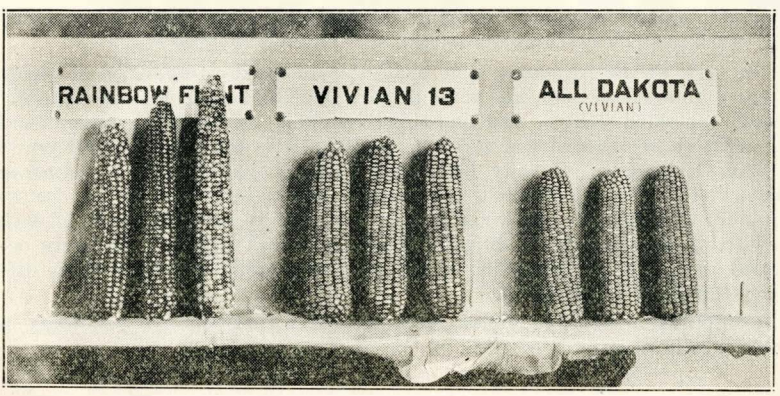


Fig. 2—At the left are ears of a well known variety of Flint corn, the type which produced the highest average number of pounds of silage. Varieties of dent have been produced in camparison.

The following Table 1 is made up of average weights of silage harvested annually from six separate acres (exception noted) planted with each of the two separate varieties of corn indicated in Fig. 1.

The separate acre yields which go to make up these averages are put down in Table 1, appendix.

Examination of the foregoing table makes it appear that the average yield for ten years was 6130.5 pounds per acre for variety Rainbow flint and 5162.6 pounds per acre for variety Vivian 13; the difference between these two average yields being 967.9 pounds, in favor of Rainbow flint.

Moreover, comparison of the averages for the separate years may indicate that the variety mentioned yielded highest in nine separate years out of ten.

Thus the average difference in yield of silage is made up by consistently greater yields produced by the variety Rainbow flint. One is apparently justified in assuming that considering the types of corn for silage represented by the two varieties in question (1) a standard variety of flint corn, (2) the other dent, **that higher yields of silage may be expected on a basis of total pounds per acre from the flint type.**

Three Methods of Planting Corn: (1) Check; (2) Drill; (3) List

It has been observed by the writer and also learned by conversation with corn growers in the Vivian area that listing corn as a method of planting has relatively increased, in comparison with the methods formerly employed, namely checking and drilling. It was the unanimous opinion of a number of growers who attended field day at Vivian, July 9, 1929, that the method of listing was almost universally employed in planting corn in the area. This observation is quoted, not to be taken as a conclusion regarding the best method of planting corn, but merely as an indication that listing is looked upon with much favor in comparison with other methods. It seems to be the understanding that is is possible to plant corn more seasonably in the spring by this method; that it likewise protects young corn plants from occasional high winds and dust storms, and may possibly conserve moisture better than other methods of planting. Such are the opinions expressed by a number of growers.

In view of the foregoing it is profitable to make comparison of yields of corn from the 12 separate acres of corn one-third of which are annually listed, one-third drilled, and one-third checked. In order to understand the relative position of the acres in question it is possible to refer again to Fig. 1, page 6. It may be stated further that the three separate series listed, drilled, checked, are rotated in succeeding years so far as manner of planting is concerned in such a way as to bring the corn of each method of planting on to different land from that which it formerly occupied so that the inequalities of soil may be equalized for the three different methods of planting.

Comparative average yields from the three methods are put down in Table 2 following:

Table 2—Corn, average yields of silage, pounds per acre, Vivian experiment farm

Year	Listed	Drilled	Checked	Av. of checked and drilled	Increase of listed corn over average of drilled and checked.
1928	6348	4918	7118	6018	330
1927	8037	7800	7349	7374	463
1926	1573	3235	1985	2610	-1037
1925	3858	1723	1730	1726.5	2131.5
1924	4730	4918	7118	6018	-1288
1923	*				
1922	11459	13714	11866	12790	-1331
1921	5216	5022	3333	4177.5	1038.5
1920	5739	4995	7075	6035	-296
1919	6695	4888	4966	4927	1768
1918	11560	7630	9060	8345	3215
Av.	6521.5	5884.3	6159.9	6022.1	

*Omitted from averages because unequally affected by hail storm.

Fig. 3—FOUR HORSES AND LISTER

The lister puts corn into furrows at one operation, and without otherwise plowing.

(Photo by E. G. Montgomery, M. M. Co.)

Examination of the yields in the foregoing table shows that **the highest average yield of silage for the ten-year period was secured from listed corn,** namely 6522 pounds per acre. The next highest average yield was secured from checked corn, with 6160 pounds per acre, the lowest average

being produced by drilled corn, namely 5884 pounds per acre. Listed corn produced as an average 362 pounds per acre more than the next highest average yield, which was produced by checked corn. Moreover listed corn produced a higher average yield of silage than either drilled or checked corn five years out of ten, and ranked either first or second in comparison with the other two in seven of the ten years. The yield of listed corn was higher than the average yield of drilled and checked corn in six of the ten years.

Checked corn, which made the second highest average yield of silage for ten years, produced the highest amount of silage in only three years out of ten and ranked either first or second in eight of the ten years.

Drilled corn, which produced the lowest average yield of silage for ten years, ranked highest in only two years out of ten and ranked highest or next highest in only five of the ten years.

So far as these experiments are concerned the practice of listing corn for silage is well warranted by the yields produced, in case other reasons recommend the method. The relative areas of corn planted in the Vivian district seem therefore to favor listing for reasons that are well founded.

Yields of Corn Silage from Manured and Unmanured Land

By referring again to Fig. 1 it may be noted that six of the separate acres of corn for silage receive applications of stall manure whereas the remaining six are not so treated.

It may be stated further that the applications of stall manure are placed on the six separate acres constituting the west half of the entire field. The six unmanured acres therefore constitute the east half. Six tons per acre have been placed on the west half annually.[1]

*In connection with the history of land occupied by these 12 experimental acres it is well to state that in the year 1917 stall manure was applied at the rate of 6 tons per acre on series H and M extending entirely across the field from east to west. Thus in this single year four of the acres now included in the unmanured east half of the field had manure applied to them. Also in 1918, all 12 acres in this field received an application of 6 tons per acre of stall manure. Accordingly the 6 acres of the east side of the field have each received at least one application of stall manure since the field was broken out of new prairie in 1915, and additionally the four following acres have received two such applications: H-3, M-3, M-4. Beginning with 1918 the acres of the west half received applications of stall manure annually and those of the east half have received none.

The following Table 3 consists of average yields of silage corn from manured and unmanured acres:

Table 3—Corn yields in pounds per acre, from series H, K, M, with and without manure

Year	With manure	Without manure	Increase of manured over unmanured
1928	4390	4608	−518
1927	7865	7591	274
1926	2053	2477	−424
1925	2527	2347	180
1924	5422	5755	−333
1923	4642	6317	−1675 (av. 2 acres).
1922	12398	12293	105
1921	3926	5123	−1197
1920	4428	7444	−3016
1919	4563	6469	−1906
Av. 10 yrs.	5221	6072	−851

Examination of the foregoing Table 3 indicates that **the average yield of silage corn for the 10 years was 851 pounds per acre higher for the six unmanured acres than for the six manured acres.** Examination of the last column in the table indicates further that the lower average yield for the

acres treated with manure was consistent to the extent that the yield was lower in seven years out of ten. The three separate years when higher yields were secured from the manured acres are fairly evenly distributed throughout the ten year period, a fact which also indicates that the greater yield secured from unmanured plots was not accidental.

Without attempting at this point to determine fundamental causes it seems apparent from Table 3 that application of manure produced no increase of corn for silage.

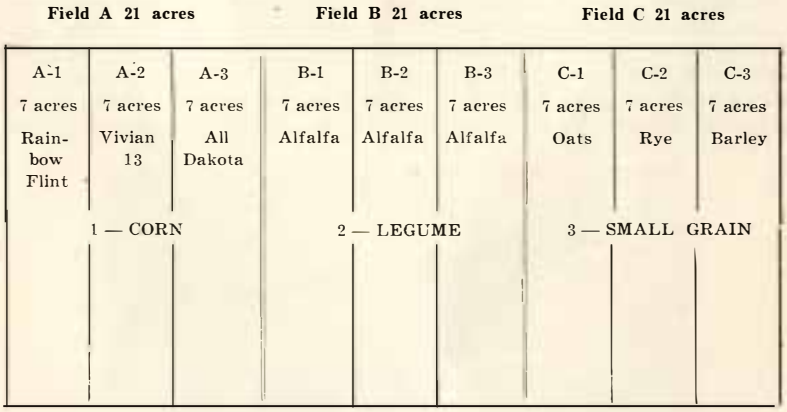
A Three Year Rotation

1. Corn, 2. Small Grain, 3. Alfalfa

One of the divisions of Vivian farm is devoted to a crop rotation of (1) corn, (2) small grain, (3) alfalfa. The three-field rotation was originally laid off and has been followed systematically for the purpose among other things of securing answers to the following questions:

1. Which of three varieties of corn, Rainbow flint, All Dakota, Vivian 13, would produce most profitably?
2. Which kind of small grain, barley, oats, or winter rye, would yield most profitably?
3. Which of the foregoing would serve as the most desirable nurse crop for alfalfa?

Each of the three fields comprised in the foregoing three-year rotation consists in turn of three equal parts. The following schematic diagram indicates the general plan of this rotation experiment, designates the fields as they are divided and the kinds of crops planted in them, for example, in the year 1929:



Plat 2—PLAN OF THREE YEAR CROPPING SYSTEM

(1) Corn (2) Small Grain (3) Legume

Including three varieties of corn, three varieties of small grain and alfalfa.

First may be considered yields of corn, produced with the crop rotation system just described:

Corn

Yields of Grain or Fodder, Produced by Corn in a Three-Year Rotation: (1) Corn, (2) Small Grain, (3) Alfalfa

Foregoing in this bulletin have been put down annual yields in pounds per acre of corn harvested for silage over a ten-year period. It is possible now to tabulate in the following Table 4 yields of corn planted and cultivated with the primary idea of producing grain:

Table 4—Yields of corn produced in bushels or tons per acre from given fields in given years.

Year	Yield in given year in tons of fodder or bushels per acre of ears of given variety.								
	RAINBOW FLINT			VIVIAN 13			ALL DAKOTA		
	Field No	Bushel ears	Tons fodder	Field No	Bushel ears	Tons fodder	Field No	Bushel ears	Tons fodder
1929	A-3	1.1	1.3	A-2	1.4	1.2	A-1	0.4	0.8
1928	C-3		1.0	C-2		1.3	C-1		1.3
1927	B-1	26.1	1.8	B-2	24.5	1.1	B-3	20.8	1.0
1926	A-3		0.7	A-1		0.6	A-2		0.8
1925	C-1		0.6	C-3	1.0	0.6	C-2	1.5	0.5
1924	B-2	3.8	1.4	B-3	3.8	1.0	B-1	4.4	1.5
1923	A-2			A-3	13.5	1.1	A-1	3.9	1.2
1922	C-3	41.2	1.5	C-1	40.3	1.0	C-2	28.9	1.3
1921	B-3	5.5	0.3	B-2	3.1	0.2	B-1	8.8	0.7
1920	A-2		0.7	A-3		0.4			
Av.		7.8	1.3		8.8	0.9		7.6	1.0

Examination of the foregoing table will make it evident that appreciable yields of grain (ear corn) were secured from all three varieties in two separate years, namely 1922 and 1927.* Yields of grain (ear corn) harvested from the varieties in question in other years, 1920-1929, were nominal and were such as to indicate that some utilization of the corn crop other than harvesting it for grain would be more profitable. Comparison of the yields of grain from these fields of corn with the annual yields of silage as put down in Table 1 would seem to indicate that the use of corn

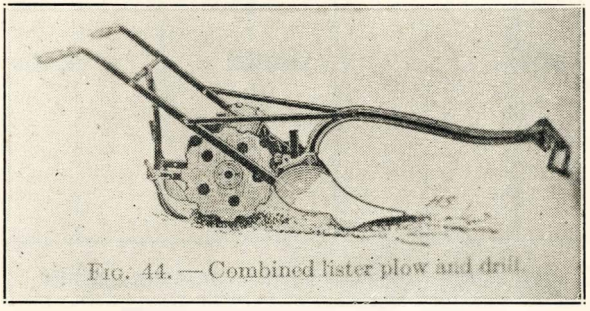


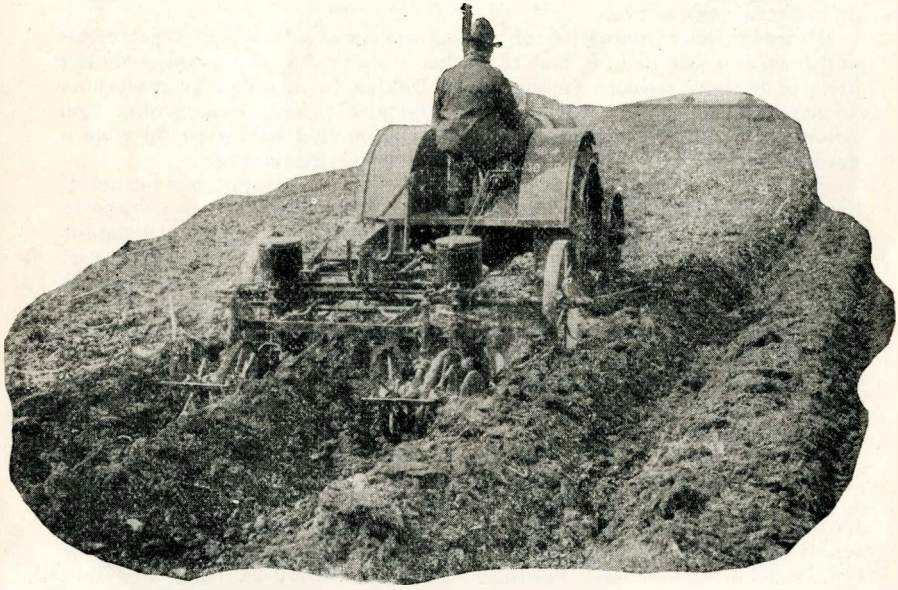
Fig. 4—A simple form of lister for planting corn
(Photo by E. G. Montgomery, M. M. Co.)

*These yields of corn put down in table 4 may be compared with those reported by U. S. Dept. Agr. See Appendix, Table 1, page 31.

for silage wherever possible would yield more profitable returns within the area indicated than the use of corn for grain. Using the foregoing statement as a basis for corn utilization and corn improvement:

1. The utilization of corn in the form of silage should be considered.
2. The search should continue for a variety of corn that will produce a greater proportion of grain in order to make corn for a grain (feed crop) more dependable.
3. In relation to crop rotation in general substitutes or supplements for corn such as sorghums, and the process of fallowing land as a preparation for succeeding grain crops. In this same connection the system of cultivating small grain and millets in rows which has already been investigated to considerable extent, is suggested.
4. Slightly the highest average yield of fodder was secured from the variety Rainbow flint which would be in general agreement with the fact cited in Table 1 that this variety produced the higher yield of silage corn.

It is a matter of some interest that the average yield of ear corn in bushels per acre is slightly higher for Vivian 13 than for either Rainbow flint or All Dakota. Inasmuch as Vivian 13 has been produced for a greater number of years consecutively at Vivian than the other varieties, this may be some indication that the variety in question is partially "acclimated."



(Cut by courtesy International Harvester Company)

Fig. 5—A MODERN TRACTOR LISTER

One advantage in using such a power machine is that it is capable of planting an entire area of corn almost simultaneously at an optimum date.

Yields of Three Kinds of Small Grain at Vivian for Ten Years

Barley, Oats, Winter Rye

Included in the three-year rotation already described, consisting of (1) corn (2) small grain (3) alfalfa, are three kinds of cereals, namely winter rye, barley, and oats. The three kinds of cereals are all seeded following corn, and are consequently put in without plowing. The winter rye is annually seeded with a drill in the fall, at the rate of 6 pecks per acre of rye of the variety Sweedish.* Barley and oats are seeded in the spring as nearly as possible on the optimum date for seeding such grains.† Barley is seeded at the rate of 5 pecks per acre and oats at the rate of 6 pecks. It may be repeated here that one purpose of including these particular kinds of small grain in a three-year rotation at Vivian was to find out the actual yields which could be produced by each kind under conditions that would make comparison possible. Furthermore it was the intention to utilize each separate kind of small grain as a nurse crop for alfalfa under conditions that would be comparable.

Table 5 gives a summary in yields in bushels per acre of each of the separate kinds of small grain indicated; also making note in each case of the field within the cropping system upon which the kind of grain in question was produced:

In the following table the highest average yield in bushels per acre from the three kinds of small grain was produced by oats, next by barley, and next by winter rye.

However, an examination of the market value of each of these crops put down in columns 5, 9, and 13, makes it clear that the average selling price of barley produced (using South Dakota farm price) is greater as an average for barley that for oats, and also greater than winter rye. **Allowing for obvious variability it would seem that barley would yield a greater return as a cash crop than either oats or winter rye.**

It should be recalled in this connection that the weight per bushel of barley is 48 pounds, that of oats being only 32. Thus if one desires to make direct comparison of these two kinds of grain frequently utilized for concentrates one may readily compute that the average yield of barley at Vivian in pounds per acre is 1056.0 whereas the average yield of oats is 838.4. Such a comparison between barley and oats is of interest in case one wishes to calculate not only the number of bushels of grain in each case which might be produced for direct sale but likewise the amounts of concentrates for feel which the two kinds of grain might be expected to yield. Apparently from the present results barley at Vivian could produce more pounds per acre than oats.

Feeders of livestock in the area indicated are interested not only in the absolute number of pounds which each of these kinds of grain will produce but likewise in relative feeding value. The indications are that barley may be used for feeding purposes sometimes as a substitute for oats and likewise as a supplementary to be mixed with oats. It may be quoted from "Feeds and Feeding," Henry & Morrison, page 301, that "crushed barley is worth more than crushed oats per pound for horses." When it is desired to feed barley to cattle it is considered necessary to

*The Date of Seeding Winter Rye—South Dakota Bu. 220.
†Spring Seeding Time—S. D. Bu. 227.

Table 5.—Yields and Value per acre of small grain (barley, oats, and winter rye) in successive years from a three year rotation, (1) corn, (2) small grain, (3) alfalfa.

Year	Yield and value of barley from field indicated				Yield and value of oats from field indicated.				Yield and value of winter rye from field indicated.			
	Field	Yield	S. D. farm	Value	Field	Yield	S. D. farm price	Value	Field	Yield	S. D. farm price	Value
1929	C-3	18.6	43¢	$ 8.00	C-1	21.4	34¢	$ 7.28	C-2	9.1	83¢	$ 7.55
1928	B-2	35.5	48¢	17.04	B-3	41.7	33¢	13.76	B-1	11.6	79¢	9.16
1927	A-3	39.3	58¢	22.79	A-2	37.5	36¢	13.50	A-1	12.2	79¢	9.64
1926	C-1	0.6	52¢	0.31	C-2	1.5	36¢	.54	C-3	0.0	Winter killed	
1925	B-3	3.2	47¢	1.50	B-1	10.3	28¢	2.88	B-2	6.4	67¢	4.29
1924	A-1	13.6	64¢	8.70	A-3	29.4	46¢	13.52	A-2	13.0	1.02	13.26
1923	C-3	21.6	40¢	8.64	C-1	39.7	31¢	12.31	C-2	10.1	49¢	4.95
1922	B-2	46.5	42¢	19.53	B-3	43.6	32¢	13.95	B-1	30.5	58¢	17.67
1921	A-2	21.6	29¢	6.26	C-1	10.4	20¢	2.04	A-3	10.4	58¢	6.03
1920	C-2	19.4	52¢	10.09	C-3	Oat hay 1½T	33¢		C-1	12.7	1.09	13.84
Av.		22.0		$10.29		26.2		$ 8.86		11.6		$ 8.64

figure in expense for grinding or crushing because the grain should not be fed whole, but barley is not at a disadvantage with oats in that respect because the same is true of the latter grain. The value of barley in hog feeding is even more generally recognized in Canada and Europe than in this country, but in northern United States barley is widely used as a hog feed. The grain must be crushed for best results in swine feeding, which obviously would add something to its ultimate cost as a concentrate. Oats are not generally considered as suitable for hog feed as barley.

Apparently a consideration of the data put down in table 5 would indicate that if one is attempting to select a cereal crop for production in the Vivian area that will yield relatively greatest return either for sale on the market or for use as feed the first choice would go to barley. Even though one should wish to produce a certain proportion of oats on any given farm within the area, barley might well be considered as the main crop among the three small grains included in this trial, and oats as a supplementary crop.

Careful examination of the crop yields of the three separate kinds of small grain indicates in general the variations in the yield of barley and oats are approximately the same, and likewise that extreme variations in the number of bushels per acre produced is greater in the case of both oats and barley than in the case of winter rye. The lower absolute variation of rye would be expected, due to the fact that the yields per acre are lower than in the case of other two grains.*

In connection with feeding rations including barley, the reader may be interested in Experiment Station bulletin 252 by Professor J. W. Wilson and others. Comparative gains are put down from feeding barley and alfalfa hay whole or ground. It appears that higher gains were made in some instances where barley was fed with alfalfa hay ground rather than whole. Gains made with feeding barley and alfalfa as a sole ration were satisfactory although according to Professor Wilson slightly higher gains would be expected in some instances with an amount of corn added to the ration. The reader is also directed to an Experiment Station bulletin soon to be published by the Animal Husbandry Department giving results of feeding trials with barley in a number of rations; also fed to several kinds of livestock.

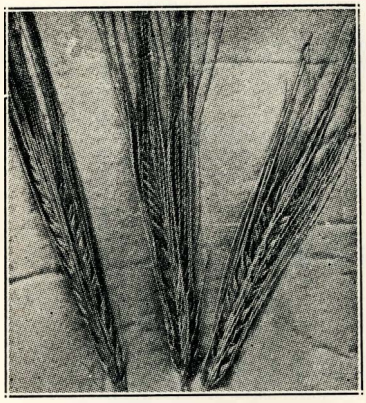


Fig. 6—THREE BARLEY HEADS

Odessa S. D. 182 Barley; the kind which produced more pounds of grain and more dollars per acre at Vivian than either oats or winter rye.

It is interesting to note that the yield of winter rye in 1926 was reported 0.0 due to the fact that it was "winter killed." In the same season a practical failure in yield of oats and

*In connection with relative yields of barley and other crops, and the consequent place of these crops in farming systems, it is worth while to note statistics of reported crop acreages harvested in Lyman County; see Appendix Table 2, page 32.

likewise of barley was reported. Obviously the value of the latter cereals, which are spring seeded, would not be due to actual winter killing. It would be interesting to find a connection if due to actual winter killing. It would be interesting to find a connection if possible between rainfalls of given seasons and crop yields of the succeeding year .

ALFALFA

Yields of Hay from Seeding in Different Kinds of Small Grain, Using the Latter as Nurse Crop

Attention has been called to the fact that three kinds of small grain are seeded in the rotation under discussion. Also it was noted that alfalfa has been seeded annually in each of the three kinds of small grain as a "nurse crop." This makes it possible to get some comparison between yields of alfalfa from land previously seeded to the three separate crops where alfalfa is included. It is necessary, of course, where alfalfa is seeded into either oats or barley, to do all the seeding in the spring, whereas seeding of alfalfa in winter rye may be accomplished either in the fall or following spring. The following Table 6 puts down comparative results of seeding alfalfa for nine separate years with the three kinds of nurse crops mentioned. It is considered important to remember that the variety of oats employed was an early variety, namely Cole. The variety of rye was Advance winter, and the barley was Odessa.

Table 6—Yields of alfalfa from seeding in three separate small grain crops

Year	Yield of alfalfa in pounds per care after given crop				
	Rye	Oats	Barley	Av. after oats and barley	Pounds higher after oats and barley than after rye
1929	2786	2927	1714	2321	-465
1928	1754	1973	2501	2237	483
1927	alfalfa failed—sudan substituted				
1926	failure—killed by drought				
1925	661	1489	1336	1412	751
1924	717	786	1414*	1100	383
1923	3150	3143	2410	2776	-374
1922	3667	4351†	3863	4107	440
1921	poor stand	1674	1648	1661	
Av.	1592	1816	1654	1734	142

*From older seeding.
†Note in plotbook says "nearly all alfalfa harvested from old plants that lived over—not new seeding."

Examination of Table 6 foregoing makes it possible to observe that average yields of alfalfa hay secured the first year after seeding in the three kinds of cereal nurse crops were 1592 pounds per acre to 1816 pounds per acre. On the basis of these averages the lowest yield was secured from alfalfa seeded in winter rye as a nurse crop; this was true four years out of six when direct comparison was possible.

Winter Rye not Favorable Nurse Crop for Alfalfa

Not only was the actual average yield from alfalfa seeded in winter rye lower than the yield secured when it was seeded in other grain crops, but also field notes indicate that labor and expense of obtaining stands of

alfalfa in winter rye were greater than that required to obtain stands otherwise.

In 1921 it was noted that there was no stand of alfalfa after seeding that crop in winter rye in the fall. In this instance the killing out of alfalfa was due largely to soil blowing in the early spring, and not only the alfalfa was killed by that condition but the rye itself was reduced to less than half a stand, and finally plowed. Nevertheless, alfalfa seeded the same spring in both Cole oats and Odessa barley made a satisfactory stand.

In 1922 alfalfa that had been seeded in winter rye in the fall produced a stand and made a yield of hay only slightly less than that seeded in barley in the spring. The yield of alfalfa thus secured may be cited as the one satisfactory crop of alfalfa secured at Vivian with the use of fall seeding in winter rye as a nurse crop. All other crops seeded under such conditions with winter rye were either entire failures or else had to be reseeded in the spring.

In 1923 alfalfa seeded in winter rye in the fall made a half stand and was reseeded in the rye stubble after harvest.

In 1924 alfalfa seeded in winter rye in the fall resulted in a poor stand and was reseeded in the stubble after the rye was taken off.

Change from Fall Seeding in Winter Rye to Spring Seeding of Alfalfa

After 1924 the plan for seeding alfalfa in winter rye was changed from fall seeding to spring seeding, and in the five years following, the trial was made of seeding this crop in winter rye in the spring at the time of seeding it in Cole oats and Odessa barley. Stands secured of alfalfa by this spring seeding generally have appeared to be as sure as comparative stands seeded in oats or barley. However, there has been nothing to indicate that even spring seeding of alfalfa in winter rye had actual superiority over seeding in oats or barley. **All in all, considering the results with both fall and spring seeding of alfalfa in winter rye, at Vivian, winter rye seems to be a poorer nurse crop than Cole oats or Odessa barley.**

It is easy to observe that the average yield of alfalfa seeded in Cole oats for nine years was 1816 pounds, whereas the average yield from seeding in Odessa barley was 1654 pounds. Concerning yields for separate years from oats and barley, one finds that the yield was higher after seeding in oats in five years out of seven when direct comparisons were possible.

If one wishes to compare yields from alfalfa seeded in winter grain with the yields from alfalfa seeded in spring grain, it is possible to note from the last column of the table that the average yield from alfalfa seeded in oats and barley is higher than the yield of that seeded in winter rye four years out of six. The difference in the average yields from the two kinds of grain, winter and spring, is 142 pounds per annum in favor of the yields from spring seeded grain.

It is noted that the yield of alfalfa in 1922 after seeding in oats was secured largely from older plants which had survived after a previous seeding of 1920 on the same land, which was then in winter rye. It is possible therefore that the higher comparative yield of alfalfa of 1922 from seeding in oats was not entirely due to any superiority of oats as a nurse crop. If one omits the yields for 1922 and secured averages for only eight years, it appears that the average yield for seeding in oats was

1499 pounds and for seeding in barley was 1378 pounds, indicating still a slightly higher yield for alfalfa that was seeded in Cole oats. As far as one can draw conclusion from the comparative yields indicated, Cole oats has been a somewhat more successful nurse crop for spring seeding of alfalfa even than Odessa barley.

Observation of Pasture Crops at Vivian

A field of approximately 20 acres occupying the north side of Vivian farm directly along the main highway has been devoted to permanent pasture. One section of the field in question was permitted to remain in native grass which has yielded the usual amount of native pasture for the region in question. Immediately west of the section just named a strip of land running lengthwise north and south of the field was plowed and seeded down to alfalfa. Immediately west of the strip of land just indicated another similar strip was plowed and seeded down to biennial sweet clover of the yellow blossomed variety and still west of the strip in yellow blossomed sweet clover a similar strip was seeded down to sweet clover of the white blossomed variety.

Thus in the same field under approximately similar conditions the several pasture crops indicated have been continued for years under comparable conditions. The entire pasture field has been utilized as a pasture for the diary herd which is mentioned in these pages as part of the Vivian demonstration farm. Quantitative yields have not been secured from the separate sections of this pasture field. It has been recognized

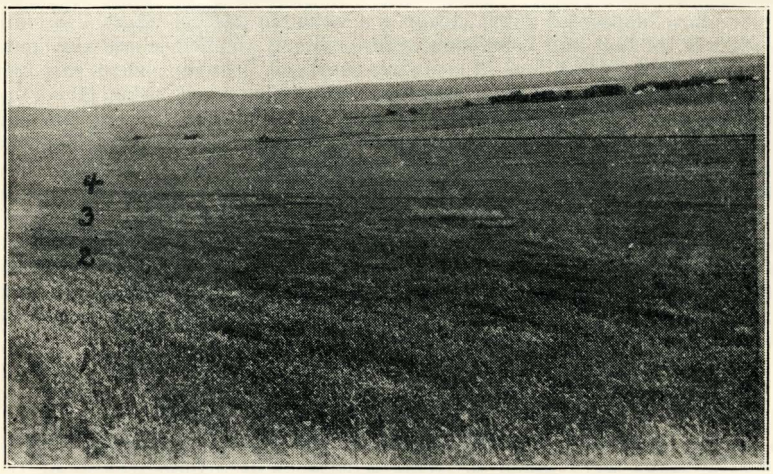


Fig. 7—VIVIAN FARM PASTURES

One pasture field is seeded with equal sized areas of (1) white sweet clover, (2) yellow sweet clover, (3) alfalfa, while the remainder of the field remains in native grass. This field is regularly pastured with dairy cattle.

(Photo by R. E. Johnston)

that such yields would constitute valuable data, but conditions have not made it practicable to go that much into detail immediately. Accordingly it is possible to mention one or two outstanding facts that have been fairly evident while the several sections of this field have been devoted to the pastures indicated.

The gate to the field through which the dairy cattle are finally turned in is located on the east side along the highway. It has been observed that in ordinary seasons under conditions of reasonably plentiful rainfall the dairy animals walk across the white sweet clover and the yellow sweet clover and usually pasture either on the alfalfa strip or even proceed across it and pasture on the part which remains in native grass.

It has been observed further, however, that in periods of continued drought the native grass pasture may and does become exhausted and somewhat dry. Likewise, the alfalfa pasture goes through a somewhat similar process, and in such instances and under such circumstances the sweet clover sections remain relatively more green and succulent. Accordingly the dairy cattle apparently learn to relish the sweet clover pasture in periods of comparatively low rainfall; also in such periods they are observed at first to pasture more continuously on the white sweet clover than on the yellow sweet clover.

The yellow sweet clover has been observed to continue growth and remain green longer and more persistently during periods of comparative drought than either white sweet clover or native grass, and even longer than alfalfa. It seems to be the case that the dairy animals avoided the yellow blossomed sweet clover until the white blossomed variety had become almost completely pastured down, then pastured upon the yellow blossomed sweet clover. Accordingly the general observation is offered that yellow blossomed sweet clover is a valuable pasture plant, especially in view of the fact that it persists under ordinary conditions and also under the more trying conditions of moisture shortage. For the season just indicated, and perhaps for other reasons, yellow blossomed sweet clover has been observed to make growth and to crowd out other plants, not only white blossomed sweet clover and native grass, but likewise alfalfa. At this point it may be well to observe the caution that yellow blossomed sweet clover ought not be seeded where there is danger that it will spread into alfalfa fields and white blossomed sweet clover fields, due to the dissemination of seed either by wind or water or otherwise. Mixtures of yellow blossomed sweet clover seed in alfalfa seed obviously will result disastrously for South Dakota seed trade. Such mixture ought to be carefully guarded against when any utilization of yellow blossomed sweet clover seems to be otherwise desirable.

Tree Planting Demonstration

At the time of the establishment of the Vivian experiment farm in 1913-14, steps were taken to locate a reasonable demonstration of tree planting. This demonstration consisted of a grove made up of a sufficient number of hard and soft wood forest trees located north of the experiment station buildings. The grove covers something less than an acre of land including the trees indicated, and also lower growing perennials. This grove of trees as it stands today is indeed one of the most hopeful

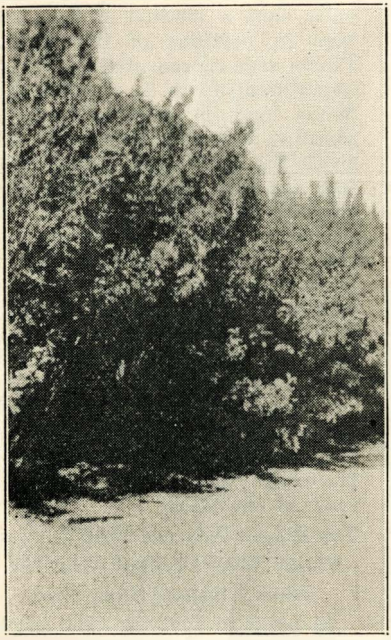


Fig. 8—CARAGANA HEDGE ON NORTHWEST OF TREE GROVE

demonstrations of successful tree planting in western South Dakota.

The trees originally planted in 1916 consisted of elm, hackberry, and cottonwood. Several green ash trees were also planted, only one of which survived at present writing. A number of Russian Olives were added, and likewise on the north, a hedge of caragana. The cottonwood trees were planted alternately with the elm and hackberry.

Elm and Hackberry Were Longer Lived than the Cottonwood

All of the trees started successfully and made notable growth until 1924 when it was found that all cottonwoods, save one, had perished during the previous winter, and the dead cottonwoods were consequently removed. There was nothing disastrous about the fact that the cottonwoods had apparently lived out their span of life, because the elm and hackberry had attained sufficient size to occupy all the available tree space in the plantation. There are at this writing 80 trees in the grove—40 elms and 40 hackberry. The elms and the hackberry are 16 feet apart in the rows, and the rows are 15 feet apart.

These trees are fourteen years old and they are approximately nine inches through at the base, standing twenty feet high. They are thrifty in every respect and are an exceedingly valuable addition to Vivian farm. They furnish a demonstration of what is clearly possible at many points.

The hardy perennials as caragana and currants are also thrifty in every way.

The Plantation is Cultivated so that Moisture Drains Toward the Trees

The theory for tree planting was announced and published briefly by Professor J. G. Hutton, of this department, that the ordinary methods of tree planting in vogue resulted in having the trees located in a row along a ridge of land. The location of trees thus on a ridge was not intentional, but often was the result of plowing the trees in by throwing two furrows together in order to cover the roots, and thereafter cultivating the tree land in such a way as repeatedly to throw soil toward the trees instead of away from them. The result of such planting and later cultivation, if any, was observed by Mr. Hutton gradually to develop a ridge along the trees with a consequent hollow between the trows of trees and the further consequence of carrying drainage away from the trees

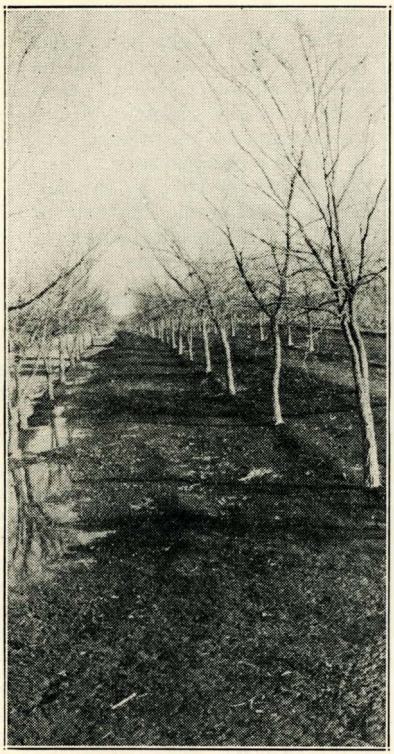


Fig. 9—VIVIAN FARM GROVE

The trees at Vivian farm are cultivated in such a manner that moisture drains toward the trees, not away from them.

instead of toward them. Theoretically such a method of tree culture in portions of the Great Plains area represented by Vivian experiment farm is a mistake. When land is prepared for tree planting it is possible first to cultivate the usual seedbed for planting, and then before actually putting the trees into place, with the use of a specially arranged road drag to throw the soil into ridges in such a way that these ridges will be lined up between the rows of trees, making opportunity for the trees to be planted in the hollows. If the hollows thus created by the road drag are not sufficiently deep an additional furrow may actually be plowed out to furnish room for planting the roots of the trees.

The Ridges Between Tree Rows at Vivian Were Created After the Trees Attained Some Size

In point of fact the tree grove at Vivian farm was not planted exactly as indicated, but was planted on level ground. Likewise it was cultivated for a number of years successfully with the use of ordinary tools such as the disk and smoothing harrow. These tools were dragged up and down the tree rows in the usual manner, with the result that by the year 1920 the tree rows in the grove were pretty well established on ridges. It was necessary, therefore, to correct this tendancy and make subsequent cultivation in such way as to drag the earth away from the trees instead of toward them, and gradually form a ridge between the trees, leaving the trees themselves in a hollow.

Home Made Road Drag Was Used for Tree Cultivation

Mr. Hussey, farm foreman, constructed a device for cultivating these trees which accomplished the desired purpose. This device was constructed after attempting to utilize one of the usual forms of steel road drag. This latter proved unsatisfactory in the particular case because it was too long and consequently failed to throw the ridge in the center of the row between the trees. It might be possible to secure a steel road drag of suitable size and length.

However, the drag constructed by Mr. Hussey was made with the

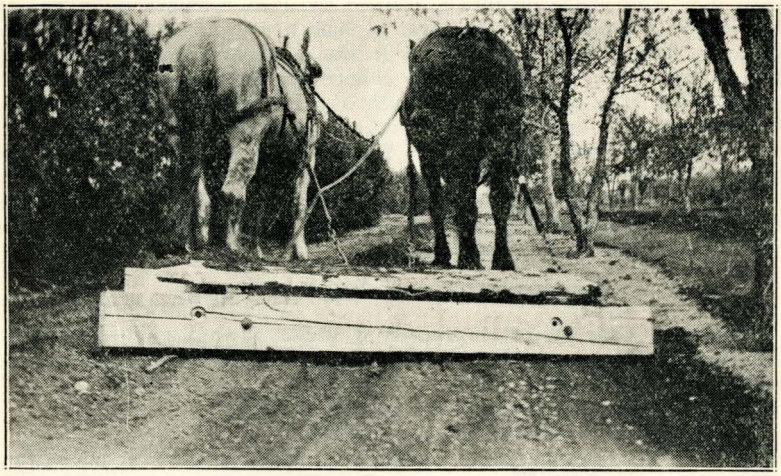


Fig. 10—THE TREE CULTIVATOR

Home made drag constructed by Mr. Hussey for tree cultivation, utilized two "2x6s" set nearly upright for blades.

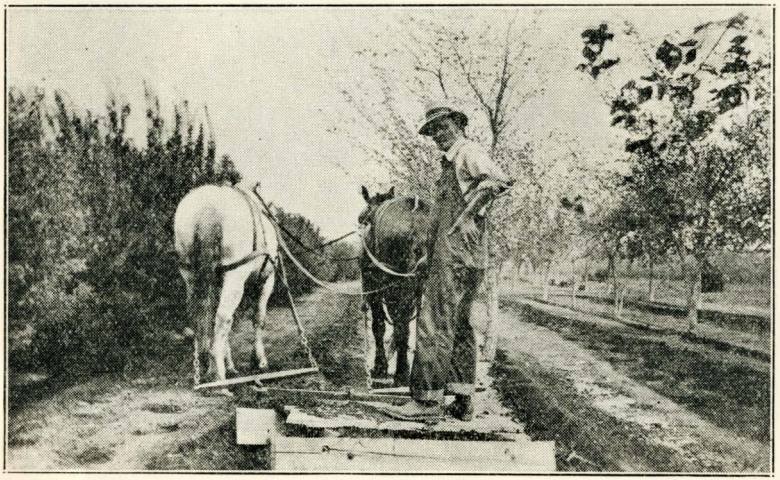


Fig. 11—SETTING THE CHAIN

The drag set at proper angle by means of a chain hitch, can be also shifted when the driver changes place of standing while driving.

use of 2 x 6 plank for blades. These were 6½ feet long, and it was found when they were made up into a drag of the design shown in Figure 10 that it was possible to use the tool in such a way as to scrape surface soil away from the trees and throw it into a ridge, midway between the rows of trees. Mr. Hussey found a chance for considerable ingenuity in arrangement of a chain hitch at such a point in front of the drag as would cause it to draw the blades at a correct angle for carrying dirt away from the trees. Likewise he found the driver may influence the angle of the drive by standing at the proper place at any given moment.

This drag has proved to be a combination cultivator and earth scraper, which apparently adheres to some improved principles in tree planting and culture for South Dakota.

Dairy Cattle at Vivian Farm

Very soon after the establishment of Vivian farm a small dairy herd was started. Two registered Holstein cows were purchased out of the Grahamholm herd. These were as follows:

Aaggie Queen Piebe Grahamholm—No. 242582

Marie Aaggie Grahamholm—No. 242576

These cows were purchased in March, 1915. Additional grade cows were purchased at about the same time so that the capacity of the dairy barn equipped with six stalls having metal partitions could be filled. The barn also contains two additional box stalls, one of which accommodates young animals of the dairy herd, and the other the herd sire.

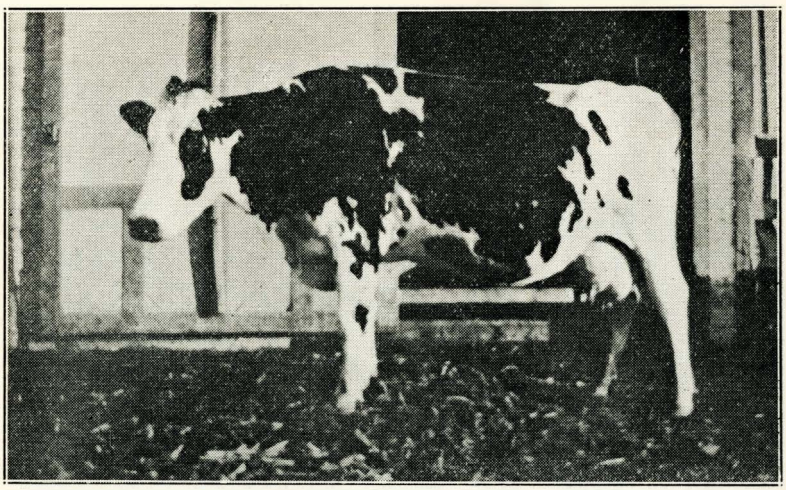


Fig. 12—AAGGIE QUEEN PIEBE GRAHAMHOLM

H. B. No. 242582

Sire—Aaggie Cornucopia Johanna Lad, Jr. No. 63974

Dam—Queen Homestead Piebe De Kalb, 2d. No. 111899

A most consistene producer at Vivian Farm from March 1915, until she was sold in June, 1927.

At the time the two original pure bred Holstein cows were purchased, a herd sire, Sir Dakota Wayne Cornucopia, No. 146074, was purchased in January, 1915. Sir Dakota Wayne Cornucopia was a grandson of the once famous College Belle Wayne.

The foregoing animals as indicated served as a foundation herd and their descendents with occasional increase by purchase have constituted a small but productive dairy herd at Vivian continuously to the present time. In the main these dairy cattle may be called a utility herd. During these years they have:

1—Consumed grain and roughage produced from Vivian farm and secured by purchase.

2—Produced approximately $60.00 per month from sale of dairy products—cream, milk, butter.

3—Furnished demonstration of T. B. free herd, the cattle being all T. B. tested annually.

4—Furnished basis for cattle breeding experiment comparing close breeding and out breeding.

5—Furnished basis for demonstration of eliminating reactors to contagious abortion test resulting in present small herd of non-reactors.

Elimination of Positive Reactors to Contagious Abortion

It has been previously mentioned that two pure bred Holstein cows were purchased when the small dairy herd at Vivian was founded, and that other cows were added to the herd at different times by purchase. Without attempting at this time to enumerate all details concerning these cattle, suffice it to say that almost from the beginning there were frequent losses in the herd, evidently due to the presence of contagious abortion. These losses in the calf crop, due to premature births, varied from year to year and were sometimes not very noticeable, but at other times the percentage of loss was rather alarming. Previous to the year 1926 one series of blood samples had been taken from the animals of the herd and had been submitted to the State Animal Health laboratory, where they were analyzed under the direction of Dr. C. C. Lipp, and pronounced free from any reaction indicating contagious abortion. However, the percentage of loss characteristic of this disease continued to be noticeable and became high in 1926. It was determined at that time to collect new blood samples and determine once more whether the disease indicated was possibly present in the herd. On November 19, blood samples were submitted to Dr. Lipp from nine individuals, and it was found that five of these reacted positive. The other four reacted negative. Thus the number of positive reactions was more than half of the total number of individuals tested, which constituted all animals in the herd.

After consulting with Professor T. M. Olson of the dairy department of South Dakota State college, and further with Dr. C. C. Lipp, of the animal health laboratory, it was determined to make a trial with this small herd on Vivian farm of the possibility of building up a herd of

non-reactors, and keeping them that way continuously. The plan decided upon was not guaranteed to be effective by the special departments consulted, but it was considered possible and simple enough to be worth attempting as a demonstration.

The plan very briefly is put down in the following steps:

1 - Submit blood samples of all individuals in the herd as often as twice per year—every six months, subsequent to the beginning of the trial November, 1926.
2 - Eliminate all positive reactors from the herd by removing them from the premises as rapidly as practicable.
3 - Use of additional care in keeping premises clean and free from reinfection, principally by hauling away all manure and scraping yard surfaces clean with a shovel wherever infection may have occurred; extra care in cleaning the barns and especially stalls of cows used in calving time; use of disinfectants on walls and floors of barn and stalls such as whitewash.
4 - Replace the animals thus eliminated from the herd by purchasing new animals subject to test and admitting only such as react negative.

Briefly the foregoing program has been followed at Vivian since 1926. The five animals which reacted positively were removed and only negative reactors retained. Four new grade cows have been added to the herd by purchase, all of which reacted negatively by test before being brought onto Vivian farm; the result has been that the herd has been found to contain only animals that react negatively to the test for contagious abortion. All individuals in the herd have been thus tested three times during 18 months, with the foregoing result.

No special conclusion is attempted with regard to the foregoing demonstration with securing a small herd of non-reactors on a given farm. The procedure is recounted here simply as part of the demonstration work carried out on Vivian experiment farm, and the results are encouraging, and seem to warrant the effort used to carry them out.

Observations of Close Breeding and Out Breeding

It was noted in the foregoing section that one individual of the foundation dairy herd at Vivian was the purebred Holstein cow Aaggie Queen Piebe Grahamholm, No. 242582. The individual mentioned remained in the herd at Vivian from the date of purchase, March 1915, until she was sold in June, 1927. This individual proved to be the most persistent producer over a series of years among the animals kept at Vivian farm, and likewise she always reacted negatively in all tests for T. B. and contagious abortion. The general vigor of this animal was especially great. It has always been interesting to note that such vigor was possessed by her as an individual and likewise transmitted to her descendants. Some years ago it was determined to observe (1) whether the characters of the individual indicated could be intensified by inbreeding and close breeding, and (2) whether such breeding would produce individuals that would be higher producers than individuals with wider lines of breeding.

Without attempting in the present report to tabulate the milk records

produced by the different cows of Vivian herd it may be explained that such records have been kept and that it has been attempted to secure an individual either by breeding or purchase that would produce a record exceeding that of Aaggie Queen Piebe Grahamholm. At least one and possibly two of the grade Holstein cows purchased at different dates have given strong indication of being as high producers for a comparatively short time, but even these individuals failed to make such a high record continuously.

It has come about therefore by process of selection and survival that the present herd of Holstein and grade Holsteins at Vivian are several of them descendants from Aaggie Queen Piebe Grahamholm. A number of individuals also among her descendants have been and are exceedingly close bred or even inbred, and it may also be stated that the degree of close breeding and inbreeding has apparently resulted in no diminuation of vigor with one possible exception.

The possible exception indicated was that of the young bull, Piebe Colantha Rue Vivian, 550228. The animal in question was placed at the head of the herd for herd sire in 1928, with the result that the animal was apparently sterile.

Records indicate that although a number of cows were bred to this animal, he has no progeny. For a time it was attempted to find some cause other than the sterility of the animal, himself a vigorous individual with all appearance of health.

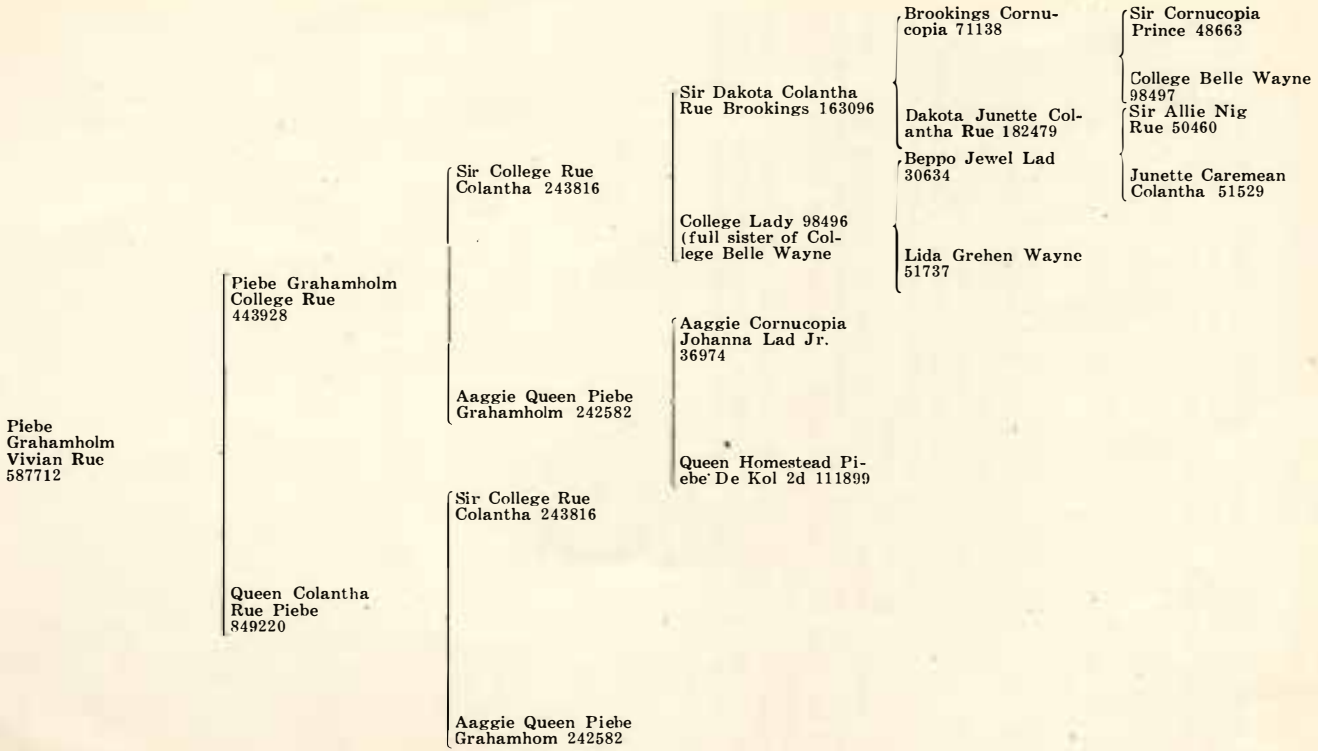
When this animal was disposed of and another one placed for sire at the head of the herd, there was apparently no more failure of the cows to breed. In this connection it is of interest to note that the new herd sire thus introduced and apparently fertile, is a full brother of the sterile animal just described and consequently having exactly the same ancestry, and the same degree of inbreeding.

The present herd sire, himself a double grandson of Aaggie Queen Piebe Grahamholm, may serve as an illustration of intensive inbreeding which has apparently resulted in no deleterious results. The pedigree of the individual just indicated is given on page 28.

Hogs at Vivian Farm

One of the demonstration features at Vivian farm is the maintenance of a small herd of hogs of the Duroc Jersey breed. One immediate purpose is to furnish utilization, by the medium of livestock, for some grain and roughage produced on demonstration fields. A pasture field containing about 20 acres of comparatively rough land cut through by Medicine creek, seeded to wild grass, alfalfa, and sweet clover, has been utilized as a hog pasture and exercise lots. The demonstration of maintaining this small herd of hogs has been generally successful. The individuals have almost invariably been thrifty and productive. Losses from such characteristic diseases as hog cholera have been comparatively few and it is believed that the well-nigh absolute control of such losses has been made possible largely through strict attention to the use of hog cholera vaccine, whenever such use appeared to be necessary.

The plan has invariably been to vaccinate all animals against cholera if and when there were reports of cholera in the region, even though such


Piebe Grahamholm Vivian Rue 587712
Piebe Grahamholm College Rue 443928
Queen Colantha Rue Piebe 849220
Sir College Rue Colantha 243816
Aaggie Queen Piebe Grahamholm 242582
Sir College Rue Colantha 243816
Aaggie Queen Piebe Grahamhom 242582
Sir Dakota Colantha Rue Brookings 163096
College Lady 98496 (full sister of College Belle Wayne
Aaggie Cornucopia Johanna Lad Jr. 36974
Queen Homestead Piebe De Kol 2d 111899
Brookings Cornucopia 71138
Dakota Junette Colantha Rue 182479
Beppo Jewel Lad 30634
Lida Grehen Wayne 51737
Sir Cornucopia Prince 48663
College Belle Wayne 98497
Sir Allie Nig Rue 50460
Junette Caremean Colantha 51529

reports might only concern localities at a considerable distance. These vaccinations have been carried out after consultation with Dr. Lipp of the State college animal health laboratory. However a veterinarian has always been employed on the ground to administer the vaccination. During the year just closed one animal was reported sick, presumably with cholera. The animal in question and all others in the herd were vaccinated against cholera. The one animal first affected died but further losses did not occur. Such is a typical instance of maximum seriousness of hog cholera occurring at Vivian farm.

It has been the practice to offer registered gilts and young male animals for sale whenever any suitable for breeding purposes were available, and it is believed the distribution of these animals has been beneficial to the herds of the surrounding area. Within the present fiscal year three young boars have been sold as indicated.

In connection with the maintenance of this small herd of Duroc Jerseys, it has been considered worth while to make fairly close observation of the relative merits of close bred and inbred lines, with lines produced by broad breeding. Broadly speaking, therefore, two systems of breeding have been conducted simultaneously with the use either of animals retained on Vivian farm after having been bred there, or secured by purchase from outside herds. Obviously the former group of animals could be used for examples of close breeding and inbreeding, whereas out crosses could be secured with the use of animals purchased.

It is not the purpose at present to offer conclusions nor even opinions concerning the relative merits of inbreeding and outbreeding based on the number of observations that have been possible at Vivian. Suffice it to say here that excellent individuals have been produced by both systems. The indications are those that might be expected, namely that characters inherent in blood lines of these animals are often made more evident through inbreeding. If and when it occurs as it did in at least one instance in Vivian herd that undesirable characters in blood lines are associated with reproduction, it may be possible for an inbred line to run out entirely.

The instance referred to was the case of the inbred line represented by MaCherie 1441456. This gilt was farrowed May 9, 1923, the daughter of Cherry's Model 1157384, the latter designated as the sow which "failed to breed." Accordingly she was displaced by his inbred daughter MaCherie, in 1924. The degree of inbreeding of MaCherie is indicated by the following pedigree:

MaCherie 1441456	Model Queen's Model 453475	High Model Again, 389571
		Model Queen, 1011494
	Cherry's Model 1157384	High Model Again, 389571
		Cherry Success 4th, 307994A.

MaCherie 1441456 produced 5 litters totaling 32 pigs in 5 years, as follows:

Year	Number progeny farrowed male	female	No. raised to maturity	Weight at farrowing pounds
1924	Total farrowed six		5	
1925	Total farrowed four		2	
1926	3	4	2	
1927	2	4	4	20
1928	3	6	5	25
Total		32	18	

The number of progeny from this young sow was not only somewhat low but also the character of the progeny was uneven, in some cases undesirable and evidently unprofitable. There is no proof in records to show that unfavorable characters in the strain were the result of inbreeding—it is possible that such characters however were segregated by that process. In this instance the unfavorable characters related not only to general lack of vigor, small size and "rickety" appearance but may have been associated with comparatively low fecundity.

At the close of her 5-year breeding period in 1928, MaCherie was in turn displaced because she failed to breed. Moreover no gilt was left among her progeny. Accordingly this inbred line was impossible to maintain directly on the female side.

A High Producing Strain of Hogs

Perhaps the outstanding demonstration furnished by the inbred MaCherie 1441456 at Vivian and her sparse and sometimes indifferent progeny is to emphasize the fact that other lines, and possibly different systems of breeding, can produce more numerous and vigorous and more profitable progeny, the opportunity for the breeder is to produce these more vigorous lines.

An example of a vigorous line produced almost concurrently at Vivian with the one previously described is that of Pathfinder Lady 1st, 1086380. The gilt mentioned was purchased in Sept. 1921, the purchase being made at South Dakota State fair, Huron, where Pathfinder Lady 1st was second in her class. A number of good judges of hogs believed she might well have been first. Obviously this gilt was introduced into Vivian herd and consequently her progeny were mainly the result of outbreeding. It is perhaps also important to state that in 4 of the 5 years of her breeding history she was mated with Vivian model 1st, a sire produced in Vivian herd but himself the result of broad breeding. It is true that in the 5th and last year of her breeding history she mated with High Models Pathfinder, one of her own progeny.

Pathfinder Lady 1st has been mentioned as an outstanding individual. In 5 years she produced a total of 46 progeny, an average of 9 1–5 per litter. Twenty-nine of these pigs were raised to maturity. The average number raised diminishes steadily with increasing age of the mother and consequent increase in weight and awkwardness.

The number of progeny is as follows:

Year	Date	Progeny farrowed: male	female	No. raised	Wt. at farrowing	
1922	5–6	2	7	9		
1923	5–1	4	5	9		
1924	5–17	4	5	7		
1925	5–6	6	3	2	25	
1926	6–13	5	5	2	14	(inbred)
1927		0	0			
1928	— Sold to shipper —					
		46		29		

The breeding history of Pathfinder Lady 1st is put down here in comparison with the foregoing MaCherie to illustrate the difference in productiveness which obtained between two animals selected as dams. Both were good in appearance and apparently vigorous but it is possible by giving attention to the actual prolificacy of the two sows to observe how much more productive and consequently how much more profitable the latter animal was than the former.

To summarize it appears that Pathfinder Lady 1st produced direct progeny numbering 46 in comparison with 32 produced by MaCherie in the same number of years—**roundly 44% more progeny from the former dam.** Such may serve as one illustration of importance of securing the most productive blood lines in breeding. Moreover 29 of the pigs from Pathfinder Lady grew to maturity, as compared with only 18 from MaCherie—**61% more for the former than for the latter.** Such a comparison may be more favorable to the progeny of Pathfinder Lady 1st for various reasons, but first hand observation led those in charge to believe that a little of the higher survival of one line over the other was due to greater vigor in the line of Pathfinder Lady 1st.

As time goes on it may be the purpose not only to produce hogs of outstanding quality at Vivian, but also to increase the number of illustrations of close breeding in comparison with broad breeding.

Appendix

Appendix Table 1—Crop Yields in Bushels per Acre Reported* for Lyman County, South Dakota, for Years 1921-1929.

Year	Yield in Bushels per Acre of Given Crop						
	Corn	Barley	Oats	Rye	Wheat		
					Durum	Spring	Total
1924	14.0	21.0	24.0	10.0			10.5
1925	9.0	19.0	20.0	9.0	9.1	9.0	18.1
1926	8.0	4.0	8.0	5.0			4.0
1927	25.0	25.0	24.0	22.0	20.5	14.5	35.0
1928	4.0	19.0	26.0	10.0	11.5	9.0	20.5
1929	8.0	16.0	18.0	15.0	11.0	9.0	20.0

*Joseph L. Orr, U. S. D. A. Division of Crop and Livestock Estimates.

Appendix Table 2—Acreage of Crops Harvested in Lyman County

Year	Corn	Barley	Oats	Winter rye	Wheat			Sweet Clover	Alfalfa	Total acreage
					Durum	Spring	Total			
1924	87,900	17,300	12,500	400			9,100	900	13,500	141,600
1925	83,600	19,800	13,600	600	5,000	5,700	10,700	1,400	13,800	143,500
1926	74,100	8,600	3,700	500			8,100	1,700	13,800	110,500
1927	92,200	27,100	18,900	1,700	7,900	8,100	16,000	2,100	13,500	173,500
1928	52,400	32,100	12,200	800	11,900	13,400	25,300	3,700	15,700	142,200
1929	76,600	37,700	10,100	1,100	17,300	15,200	35,800	3,400	15,200	296,800

1927—Sweet clover and alfalfa acreage includes both Lyman and Todd counties.
Reported by—Joseph L. Orr, U. S. D. A. Division of Crop and Livestock Estimates.

Annual Rainfall by Months at the Several Stations

Brookings

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1905	0.22	1.00	0.68	1.01	6.14	6.09	0.98	4.54	2.16	1.50	2.45	T	22.77
1906	0.17	0.02	0.58	1.40	3.51	4.87	1.86	4.28	5.13	3.01	0.89	0.52	26.26
1907	1.06	0.28	0.55	1.07	2.36	5.65	3.77	1.41	1.28	0.96	0.10	1.12	20.21
1908	0.26	1.80	1.16	2.10	6.46	6.35	4.69	2.37	3.89	1.43	1.30	0.42	32.17
1909	1.20	1.57	0.37	1.16	4.85	2.29	2.44	3.39	1.67	1.71	0.65	1.14	22.44
1910	1.07	0.40	0.35	2.34	0.87	1.85	1.68	2.46	0.96	0.38	0.17	0.10	12.63
1911	0.61	0.53	0.53	1.62	1.90	3.78	3.32	3.81	3.08	5.12	0.23	0.42	24.95
1912	0.28	0.24	0.26	3.36	6.98	2.09	2.52	4.68	1.61	0.96	0.00	0.20	23.18
1913	0.02	0.09	0.45	2.24	3.60	1.96	2.99	1.33	1.55	1.18	0.81	0.09	16.31
1914	0.22	0.40	0.42	1.64	4.16	6.67	1.62	3.16	3.32	2.21	T	0.33	24.15
1915	0.18	1.12	0.18	2.03	2.12	3.28	3.04	3.52	2.68	1.37	0.28	0.62	20.42
1916	1.47	0.32	0.40	2.95	3.72	4.27	0.40	2.03	0.84	0.45	0.03	0.36	17.34
1917	1.54	0.47	1.09	3.09	3.08	3.49	2.03	1.20	2.89	0.12	0.04	0.31	19.35
1918	0.19	0.14	0.44	1.28	3.40	1.85	3.95	4.19	0.72	1.56	1.61	1.09	20.42
1919	0.07	0.63	0.73	1.90	3.87	9.30	5.60	1.48	1.69	1.14	1.35	0.10	27.86
1920	0.34	0.24	1.85	2.95	3.84	7.27	5.45	2.15	1.99	0.66	1.30	0.30	28.34
1921	0.09	0.05	1.49	1.42	2.99	0.85	3.44	2.11	4.25	0.27	0.50	0.10	17.56
1922	0.40	1.73	0.79	0.42	1.82	3.75	2.81	1.70	0.36	0.81	3.08	0.20	17.87
1923	0.27	0.07	0.29	3.00	2.59	5.74	1.94	3.03	1.73	1.41	0.23	0.23	20.53
1924	0.10	0.31	1.34	1.82	1.32	6.88	1.22	3.89	1.02	0.84	0.11	0.35	19.20
1925	0.11	0.06	0.22	1.88	0.49	6.17	1.26	0.64	0.77	0.26	0.57	0.33	12.76
1926	0.70	0.06	0.14	0.13	1.44	3.64	3.14	1.46	2.10	0.68	0.56	0.63	14.38
1927	0.14	0.35	0.83	4.04	4.29	1.46	4.88	0.35	1.98	0.49	0.49	1.10	20.40
1928	0.09	0.30	0.44	0.96	0.53	2.97	2.69	4.52	1.37	1.68	0.78	0.15	16.48
1929	0.96	0.45	0.68	3.32	2.11	1.12	3.25	2.33	4.80	2.41	0.04	0.07	21.54

Annual Rainfall by Months at the Several Stations (Cont'd.)

Cottonwood

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1910	0.66	0.97	0.76	1.06	2.54	1.30	1.11	0.48	0.82	0.32	0.53	3.00	12.65
1911	T	0.15	T	0.85	1.10	0.64	0.59	2.41	3.59	1.15	0.20	0.42	11.10
1912	0.17	0.05	3.00	3.32	1.18	0.95	2.42	2.42	1.30	0.11	T	0.12	16.04
1913	0.16	0.10	0.43	1.15	2.95	0.59	0.81	1.84	1.15	0.76	0.14	0.38	10.46
1914	0.03	1.18	0.35	2.26	2.35	1.64	1.04	1.88	1.19	2.23	0.02	0.84	15.28
1915	0.39	1.57	0.46	2.80	6.61	4.79	4.58	2.51	2.42	0.90	T	0.10	27.31
1916	0.04	0.02	0.04	0.81	3.87	1.83	1.80	2.22	0.18	0.57	0.15	0.14	11.67
1917	0.45	1.50	0.31	0.80	3.30	0.62	0.90	2.00	1.17	0.14	0.39	0.50	12.08
1918	0.32	1.50	0.34	2.27	2.78	1.37	2.29	3.43	1.43	0.28	0.11	0.25	16.37
1919	0.04	0.29	0.71	3.57	1.29	4.97	2.05	0.20	0.25	2.03	0.71	0.20	16.31
1920	0.27	0.54	0.58	2.80	5.83	4.02	0.67	1.87	1.63	0.93	0.36	0.18	19.68
1921	0.17	0.10	0.17	0.40	2.91	0.78	3.58	1.10	0.41	3.43	0.29	0.21	13.55
1922	0.94	0.32	0.0	1.25	2.37	5.43	6.48	0.72	0.16	0.92	2.32	0.0	21.41
1923	0.0	T	0.0	0.66	2.41	4.87	5.28	3.08	3.05	1.89	0.18	4.00	25.42
1924	0.0	0.0	0.32	0.06	0.29	3.03	1.78	1.48	3.05	0.85	0.31	0.17	11.34
1925	4.00	0.20	1.07	1.17	0.72	4.80	0.60	0.39	0.49	0.48	0.08	2.10	13.41
1926	0.0	0.5	0.0	0.75	2.77	1.97	3.52	1.56	0.37	1.12	1.06	0.0	13.62
1927	2.0	0.0	0.03	2.74	5.16	3.26	2.38	2.21	0.63	T	0.0	0.0	16.61
1928	0.0	0.03	0.86	0.35	1.14	3.83	3.11	0.94	1.65	1.19	0.77	T	13.87
1929	0.46	0.03	4.34	2.51	2.20	3.56	1.74	0.89	1.44	0.61	0.10	0.03	17.91

Annual Rainfall by Months at the Several Stations (Cont'd.)

Highmore

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1908	T	0.53	0.00	1.35	2.68	5.78	2.49	3.53	0.62	2.19	1.39	0.31	28.87
1908	0.26	0.34	0.13	0.30	4.72	1.69	1.81	3.74	1.70	1.04	0.71	1.41	17.85
1910	0.82	0.19	0.58	1.40	0.94	3.74	0.85	0.66	0.89	0.24	0.40	0.44	9.05
1911	0.11	0.39	2.54	0.32	2.31	0.09	2.69	2.52	3.06	1.05	0.35	0.44	15.87
1912	0.13	0.11	0.27	1.05	2.20	1.31	1.44	3.39	0.71	0.20	0.0	0.35	12.00
1913	0.05	0.30	0.87	1.27	4.56	0.97	1.79	1.20	0.53	0.61	0.03	0.28	12.46
1914	0.13	0.62	0.45	3.65	2.23	4.09	2.01	1.16	1.01	1.92	--	0.25	17.52
1915	0.43	1.28	0.37	2.50	3.48	4.87	5.55	0.78	2.36	1.15	0.32	0.20	23.29
1916	1.40	0.27	0.74	0.89	4.15	4.54	2.10	4.10	2.75	0.58	0.13	0.47	22.12
1917	1.12	0.52	1.27	2.79	2.04	2.04	1.91	0.68	2.03	0.06	0.07	0.27	14.80
1918	0.60	0.25	0.45	2.57	3.57	1.59	5.26	1.88	0.62	0.49	1.10	0.86	19.24
1919	0.10	1.35	1.24	1.96	6.63	1.95	2.65	0.82	0.54	2.16	1.80	0.15	21.35
1920	0.27	0.33	1.20	2.56	6.04	7.05	3.56	2.47	1.51	0.75	0.34	0.20	27.08
1921	0.25	T	0.49	1.78	2.60	0.55	3.10	3.68	4.79	1.20	0.33	0.20	18.97
1922	0.45	0.93	1.05	0.93	2.78	3.65	2.85	0.41	0.48	0.39	2.83	0.35	17.10
1923	0.42	0.01	1.01	1.63	2.04	5.15	3.81	5.01	1.17	0.87	0.21	0.19	21.52
1924	0.07	0.58	1.63	1.40	0.50	5.66	2.11	1.13	2.69	1.10	0.34	0.82	18.03
1925	0.60	0.21	0.08	1.30	1.08	5.39	0.70	1.49	0.71	0.12	0.20	0.52	12.40
1926	1.56	0.0	0.03	0.16	1.96	9.50	2.53	2.09	1.07	2.78	0.16	0.36	14.20
1927	0.21	0.08	0.85	3.35	5.80	2.22	1.04	1.77	1.47	0.83	0.71	0.76	19.09
1928	0.04	0.22	0.48	1.11	0.96	2.94	2.50	2.32	0.76	1.66	0.91	0.09	13.99
1929	0.67	0.22	1.75	2.76	1.89	1.71	0.69	1.55	1.76	3.08	0.33	0.05	16.46

Annual Rainfall by Months at the Several Stations (Cont'd.)

Eureka

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1909	0.10	0.45	0.14	0.50	2.65	3.35	2.21	1.39	1.25	0.17	0.60	2.40	15.21
1910	0.60	1.70	1.23	0.82	0.42	3.80	0.53	2.60	3.65	0.18	T	0.25	15.78
1911	0.50	0.73	0.63	2.24	0.97	1.29	0.43	3.27	1.15	0.61	0.88	0.80	13.79
1912	0.25	0.40	1.05	1.29	3.37	1.50	2.19	3.27	1.43	0.07	T	0.11	14.93
1913	0.10	0.03	0.09	0.68	1.97	2.91	2.16	1.53	0.54	1.52	0.06	0.52	12.11
1914	0.22	0.05	0.13	2.07	2.20	4.28	1.25	2.11	0.70	0.87	T	0.53	14.41
1915	0.90	1.08	0.23	1.83	2.58	4.66	3.38	2.47	3.74	3.10	0.56	0.36	24.89
1916	0.79	0.13	1.78	0.88	3.57	4.16	--	4.62	1.05	0.29	0.14	0.06	17.47
1917	0.40	0.20	1.46	2.18	1.30	1.61	1.04	0.93	0.67	0.06	2.00	0.75	12.60
1918	0.14	0.50	0.58	1.98	1.97	0.93	1.03	1.77	0.36	0.55	0.53	0.20	10.54
1919	0.07	1.04	0.52	1.28	3.68	2.29	4.08	0.77	0.04	1.13	0.12	0.32	15.34
1920	0.16	0.08	0.27	1.63	1.82	4.26	2.49	2.05	3.90	0.36	0.54	0.09	17.65
1921	0.44	0.06	1.27	3.74	3.31	0.52	4.57	4.45	3.29	1.64	0.36	0.24	19.90
1922	0.16	0.94	0.30	0.89	3.39	3.38	1.66	0.45	0.54	0.63	3.90	0.23	16.47
1923	0.13	0.17	0.35	1.31	3.55	4.17	3.67	1.72	2.56	1.52	0.22	0.20	19.57
1924	0.02	0.24	0.48	1.28	0.44	5.24	3.29	1.35	2.65	2.16	0.0	0.27	17.42
1925	0.41	0.01	0.17	2.37	1.08	6.56	0.70	1.38	1.38	0.31	0.17	0.09	14.63
1926	0.0	0.0	0.0	0.25	2.66	1.18	1.16	2.45	3.21	0.81	0.16	0.0	11.88
1927	0.0	0.27	0.19	1.31	3.72	2.90	6.39	3.43	1.15	1.89	0.05	0.39	21.69
1928	0.36	0.07	0.12	1.05	0.11	4.55	3.68	2.56	3.30	1.15	0.52	0.06	17.53
1929	0.52	0.24	0.36	1.06	1.57	0.77	2.42	0.70	1.55	2.57	0.17	0.09	12.02

Annual Rainfall by Months at the Several Stations (Cont'd.)

Vivian

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1915	0.50	1.77	1.19	2.62	3.02	4.31	6.76	1.12	3.16	1.12	0.38	0.03	25.98
1916	1.00	0.04	0.29	1.08	3.46	4.49	3.53	3.52	0.90	0.57	0.12	0.04	19.04
1917	1.35	0.18	1.00	2.38	5.20	1.18	1.02	2.01	2.64	0.0	--	4.32	17.28
1918	1.10	0.50	0.50	3.92	3.33	1.70	2.07	3.32	0.75	0.82	0.22	0.90	19.13
1919	0.0	0.33	0.66	4.14	3.23	5.01	4.00	0.94	1.70	1.95	1.91	0.13	23.99
1920	0.0	0.58	1.52	4.55	7.51	5.54	3.42	1.86	0.80	2.09	1.32	0.28	29.47
1921	0.19	0.01	0.68	1.53	4.23	1.22	4.34	0.44	3.55	1.68	0.63	0.28	18.78
1922	0.47	0.40	0.75	0.71	2.49	5.85	3.44	3.86	0.27	0.45	2.3-	0.15	21.16
1923	0.03	0.03	0.0	1.47	1.59	4.04	1.98	3.19	1.03	1.03	0.33	1.50	16.22
1924	0.0	0.70	0.85	0.90	0.05	4.44	2.14	1.16	1.79	1.17	0.28	0.40	13.88
1925	0.17	0.12	0.04	1.00	0.49	7.53	2.00	1.16	0.02	0.28	0.18	0.35	13.03
1926	1.37	0.17	0.0	0.04	2.17	3.05	1.40	0.60	1.28	1.15	0.03	0.29	11.55
1927	0.03	0.02	1.06	6.65	6.41	1.88	1.38	1.40	0.59	1.54	6.35	0.73	21.99
1928	T	0.16	0.92	0.17	2.24	4.70	1.26	0.55	0.71	1.74	0.78	0.07	13.30
1929	0.75	0.53	1.19	4.17	1.96	2.27	0.37	0.42	2.33	5.59	0.57	0.13	20.28