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Bulletin No. 205 March, 1924

SOME TENTATIVE STATEMENTS CONCERNING

FOWLDS HULLESS OATS

By Agronomy Department

Written by
A. N. HUME

Sixty Day Swedish Select Fowlds Hulless Oats

AGRICULTURAL EXPERIMENT STATION
SOUTH DAKOTA STATE COLLEGE OF
AGRICULTURE AND MECHANIC ARTS

Brookings, South Dakota

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H. M. Crosby ..... Bulletin Clerk and Stenographer

SUMMARY OF BULLETIN

"A hulless oat, but little known in this country, serves well for poultry and swine, while the varieties with hulls are preferable for other stock." Feeds and Feeding, Henry and Morrison, 1923, par. 222. Page 623

"We have had some pretty fair success, in the county, raising hulless oats. Yesterday a man asked me whether hulless oats had strong enough straws to put on summer fallow." County Agent W. C. Boardman.

Quoted from a typical letter received from a South Dakota county agent.

Comparative yields, secured at Brookings in 1923, indicate that hulless oats (Fowlds S. D. 1262) yielded a somewhat lower number of bushels per acre than the best standand varieties of ordinary oats. Page 617

The same comparative yields for this season indicated that a hulless variety yielded a lower number of bushels per acre than the best standard varieties, even when the latter were reduced to a hulless basis. Page 621

Samples of hulless oats contained a higher percentage of raw protein than the whole grain of ordinary varieties, but a lower percentage than the kernels (grains with hulls removed) of the same varieties, according to analyses made in agronomy laboratory by Professor Bushey. Table III. Page 621

The higher yielding varieties of ordinary oats produced a larger yield of raw protein per acre than hulless oats both on a basis of the whole grains and on a basis of kernels (grains with hulls removed) as computed from analyses made in agronomy laboratory by Professor Bushey. Table III. Page 621

The results of this one season, 1923, at Brookings would indicate that where hulless oats are produced they would be intended as a special feed for certain classes of animals, especially young animals, rather than as a general farm crop for all conditions.

The experimental work in developing the best possible hulless oats will be continued by Professor Fowlds and reports of progress made later.

SOME TENTATIVE STATEMENTS CONCERNING A VARIETY OF HULLESS OATS

By
Agronomy Department

Written by A. N. Hume

Throughout the past three seasons considerable interest has been manifested among South Dakota grain growers in the subject hulless oats. One or two strains of such oats have been imported from Canada and distributed by seedsmen and others. Likewise some notices have become current relating to Fowlds Hulless oats, which is named for the individual who developed the strain at South Dakota Experiment Station, Brookings.

These strains of hulless oats have been recommended usually for growing for the purpose of making feed, especially for young animals. They have given satisfaction as a substitute for oatmeal, especially for young pigs. The fact that these strains of hulless oats have been widely used, although not over a large area, has given rise to numerous direct inquiries about their qualities. Nearly all of these inquiries come from prospective growers who desire to know whether or not they would be justified in sowing increased areas of these oats the coming spring.

The purpose of the present statement is to furnish as much definite information as practicable at the present time in reply to these inquiries, in the hope that, although incomplete, it may be of immediate value as an indication for further procedure. The information which the Agronomy Department has now available relates to the strain developed here, namely, Fowlds Hulless oats.

Will Hulless Oats Yield as Much Per Acre as Ordinary Oats?

At various times during the two or three years while Mr. Fowlds has conducted head-row tests of the variety in question, he has stated the general fact that hulless oats are not likely to yield as many bushels per acre as good standard varieties. Such a statement is based on comparative

head-row yields in the nursery plots at Brookings. In the season of 1923 it was possible to include a strain of Fowlds Hulless oats, S. D. 1262, in the fiftieth acre field tests of oat varieties on the West Farm, Brookings. The comparative yields secured from this test should be considered not as a final statement but as definite information now available. Furthermore, it may be stated that the yields of the several varieties in question are included in order to state their comparative yield for this one season only along with the yield of hulless oats.

TABLE I

Comparative Yields of Oat Varieties—Brookings, 1923

Name and Number of Variety	Total weight of grain and straw per acre	Yield of grain in pounds per plot (1/50 acre)	Yield of grain in bushels (32 pounds) per acre
Iowa 105	85	35	54.60
Sixty Day 165	100	34	53.04
Sixty Day (Minn.)	91	34	53.04
Sixty Day 158	90	32	49.92
Iogren	90	32	49.92
Iowar	83	31	48.36
Early Champion	84	30	46.80
Cole 316	85	28	43.68
Victory	92	27	42.12
Texas Red	83	26	40.56
Silver Mine 1143	77	25	39.00
Irish Victor	77	25	39.00
Minota 1240	77	25	39.00
Swedish Select	77	25	39.00
New Victory	85	25	39.00
Minn. 358	82	24	37.44
Golden Rain 1020	83	23	35.88
Sixty Day 165	63	22	34.32
Lincoln	81	19	29.64
Vassal	75	17	26.52
White Russian	75	15	23.40
Fowlds Hulless	76	15	23.40

The foregoing comparative yields as put down in the last column of Table I are in accord with the general observation previously mentioned to the effect that hulless oats are likely to yield less from the standpoint of bushels per acre than standard varieties of ordinary oats. In 1923 it will be observed that the lowest number of bushels per acre were produced by hulless oats based on the number of pounds produced in each fiftieth acre plot.

It may be mentioned again that field tests of a single year should not be considered final. In all such tests the coefficient of error is high. In this particular instance the Agronomy Department believes that the inequality of soil as well as inequality in yield due to dates of ripening and consequent time of cutting were very appreciable. One indication of variation in yield within the series may be observed by noting that one of the plots of Sixty Day S. D. 165 yielded 53.04 bushels per acre while another located farther down in the series yielded 34.32, the former yield being 54.5 per cent greater than the latter. Thus it is entirely possible that the plot of hulless oats produced a relatively lower yield on account of having a relatively poor position in the test.

It remains true, however, that even if hulless oats in this test had produced 54.5 per cent more bushels per acre (32 pounds per bushel) it would still have ranked seventh from the bottom of the list in point of bushels per acre in comparison with other yields as now recorded. The indication of these yields available at the present time are therefore in accord with the general opinion that hulless oats may not be expected to outyield standard commercial varieties on a bushel per acre basis.

Comparative Yields of Hulless Oats and Ordinary Oats Secured by Growers

In the foregoing paragraph a particular variety of hulless oats included in the test was Fowlds hulless. At the present time it is not possible to make comparisons of yielding power of different strains of hulless oats but rather to get some idea of whether the character of hulless oats in general is likely to go along with relatively high yield. Inquiries were sent out to nine growers who had corresponded with Extension Agronomist Ralph E. Johnston in regard to hulless oats. The questionnaire sent out to all these growers was as follows:

1. How many bushels of hulless oats per acre?
2. How many bushels of ordinary oats per acre?
3. Do you find hulless oats a valuable crop?
4. For feed?
5. For market?

Replies were received from all of the nine growers. It would be interesting and instructive to publish all the replies

in full but it is possible to summarize the main facts in the following table:

TABLE II

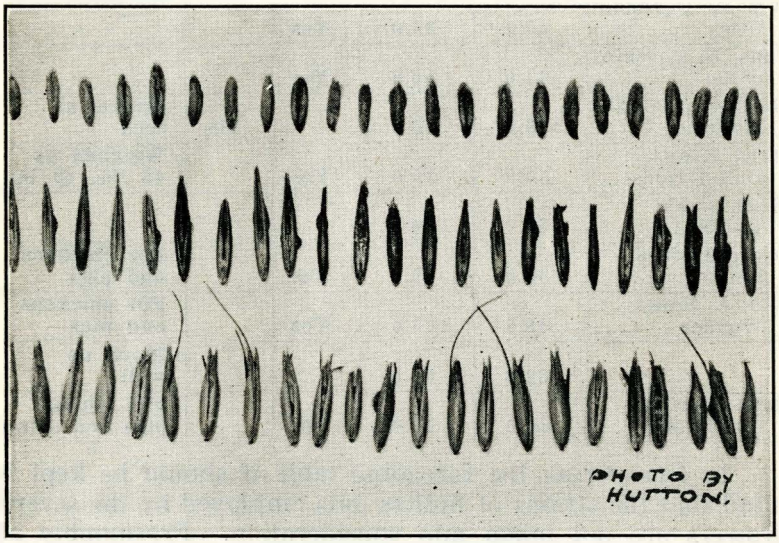
Summary of Replies from South Dakota Growers of Hulless Oats (1923)

Name of Grower	Yield in bushels per acre (32 lbs.)		Are hulless oats a valuable crop		Remarks
	Ordinary oats	Hulless oats	For feed	For market	
G. W. Preston, Hitchcock	41.0	18.0	Yes	No	Measured bushels
Wm. A. DeJong, Utica	60.0	35.0	Yes		
Chas. E. Cheskey, Selby	44.0	50.0	Yes		
Herman J. Bohl, Mellette	28.7	25.0		Yes	Market as seed
Hans Evans, Dell Rapids	50.0	36.0	Yes		Weighed as 45 lbs. @ bu.
Hugh Nash, Redfield	55.0	30.0			
Oscar Fodness, Lennox	35.0	30.0	Yes		For chickens and pigs
Geo. J. Hasse, Warner	38.0	35.0	Yes		For chickens and pigs
"	52 0	60.0			Stood up well
Geo. Pierson, Claremont	60.0	41.0	Yes		For young pigs and calves

In considering the foregoing table it should be kept in mind that the strains of hulless oats employed by the several growers are not taken into consideration. Presumably all of them were secured by the growers from seed firms of our state who in turn procured seed stocks from Canadian sources. In the second and third columns of the table nine yields are put down on a comparative basis of 32 pounds per bushel. It may be noted that on this basis in nine of the trials growers of ordinary oats yielded more bushels per acre than hulless oats. In the right-hand columns of the table it is only possible to put down very brief remarks as quoted from the growers. In all cases, however, growers were highly pleased with the project of producing hulless oats for the special purpose of feeding to young animals and poultry. All the growers seemed to feel that if hulless oats

yield slightly less than ordinary oats on a basis of bushels per acre they make up for it for the special purpose of feeding young animals by being free from hulls. All of the replies indicate that the growers are all to continue to produce a certain acreage of hulless oats for special purposes. None of the growers expressed the belief that hulless oats is any less hardy nor any less drought resistant nor any more likely to lodge than ordinary oats.

The collective experience quoted from nine growers is in substantial agreement with head-row observations and one year of variety test made by the Agronomy Department at Brookings.



Above—Grains of Fowlds Hulless Oats
Middle—Grains of Sixty Day Oats
Lower—Grains of Swedish Select Oats

Will Hulless Oats Produce as Much Total Protein Per Acre as Standard Varieties?

The foregoing paragraph might indicate that hulless oats would not be indicated as the best variety to use for producing grain for the market on an ordinary basis. It might still be an interesting question whether hulless oats although producing a smaller number of pounds or bushels (32 pounds per bushel) per acre might not be rich enough

in protein to outyield other varieties from the standpoint of nitrogen constituents. Analyses of the several varieties of oats for protein (N x 6.25) were made in the agronomy laboratory by Professor A. L. Bushey, agronomy analyst. Analyses were made in duplicate with weighing out approximately 2.5 to 4 grams of total grain of each given variety. These analyses were made with air dry samples of oats of all varieties although it had been determined previously that variation in moisture content for the several samples were slight.

Nitrogen determinations were made of samples of whole grain. After making such determinations samples of the same varieties were weighed out and the hulls were removed by hand picking from the samples of the ordinary varieties. Thus it was possible to take the weights of kernels and hulls separately in the ordinary samples and further to compute the percentages of hull. All grains contained in the samples thus utilized were weighed. Certain grains were found to contain no kernel whatever, in which case such grains were weighed in with the total amount of hulls in the sample.

Not only the percentages of hull in the several samples were thus determined but likewise duplicate protein (N x 6.25) determinations were made of protein in hulls and protein in kernels. The following table gives a summary calculated from data thus secured of pounds of protein produced per acre with four varieties in the test of 1923; first, on a basis of whole grain, and second, on a basis of kernels alone (defining kernels as grains with the hulls removed).

TABLE III

Percentages of Protein and Pounds Per Acre Produced of Protein in Whole Grain and in Kernels of Four Varieties, Including Fowlds Hulless. (Analyses by Professor Bushey.)

Variety	Yield in bu. (32 lbs.) per a.	% hull in grain	Yield of hull free grain in bu. (32 lbs.) per a.	% protein in whole grain	% protein in hulls	% protein in kernels	Pounds protein per a. (Nx6.25) in whole grain	Pounds protein per a. (Nx6.25) in kernels
Iowa 105	54.6	28.7	38.93	14.31	3.88	19.09	250.02	237.81
Sixty Day	43.7	28.8	31.11	15.18	4.39	19.00	212.28	189.15
Fowlds Hulless..	23.4	.....	23.4	17.25	.....	17.25	129.17	129.17
Swedish Select..	39.0	37.2	24.49	14.18	4.22	19.96	176.97	156.42

In explanation of the foregoing table it may be noted from the fifth column headed "percent protein in whole grain" that the variety Fowlds Hulless analyzed 17.25 per cent which was higher than that contained in any of the ordinary varieties. It would be expected that a variety of oats in which the threshed grain contains no hulls whatever could analyze a higher percentage of protein than ordinary varieties, even though the hulls themselves contained a very appreciable percentage of protein as was the case in the varieties of this table. When one examines the percentage of protein in the kernels, however, as put down in the third from the last column of the table, the situation relative to protein content is changed and it appears that the percentage of protein in the kernels of hulless oats is lower than the percentage of protein in any of the three hulled varieties.

With the use of the original yields and the percentages of hull in the grain the yield of hull-free grain was computed and these yields are put down in column three. These yields of hull-free grain would seem to furnish a reasonable basis for comparison of ordinary varieties with a hulless variety even when all varieties are calculated to a basis of bushels (32 pounds) per acre. In column three it appears that in the present season and in the present test the highest yield of hull-free grain was produced by Iowa 105 (a Kherson selection made by Iowa Experiment Station). The next highest is produced by Sixty Day S. D. 165; the next highest yield was produced by Swedish Select, and the next by Fowlds Hulless.

In the next to the last column may be found comparative yields computed on a basis of pounds of protein (N x 6.25) in the whole grain with amounts varying from 129.17 in the case of hulless to 250.02 in the case of Iowa 105. Again in the last column of the table our results from computing yields of protein per acre (N x 6.25) in kernels alone (kernels being defined as grains with the hulls removed) it was found that the pounds of protein produced in the kernels likewise vary, 129.17 pounds per acre in hulless to 237.81 in Iowa 105.

So far as one may consider a test of one year and of the kind here indicated as an indication, one would conclude that ordinary varieties may be expected to yield not only more bushels per acre on a basis of pounds but likewise more bushels of kernels per acre with all hulls removed, and

furthermore more protein per acre both on the basis of whole grain and on the basis of kernels with hulls removed.

Hulless Oats Apparently a Special Purpose Crop

Such a statement would in no wise detract from the merit of hulless oats for a special purpose of feeding young animals. The statement would correspond again with the idea that hulless oats will continue to be utilized as a special purpose crop for feeding and probably not for a grain crop to compete with ordinary varieties of oats now produced.

It is not the purpose of the present statement to discuss the relative feeding value of hulless oats at great length. South Dakota feeders have already spoken very favorably of the grain for young animals. It may be recalled in general that oats, although relatively expensive feed for livestock, is, next to corn, the most extensively grown cereal in America. A perusal of feeding experiments with oats for various animals indicates almost invariably that oats is a feed of high quality rather than a cheap feed. In "Feeds and Feeding," written by Henry and Morrison, one finds that "oats are the safest of all feeds for the horse. . . . It was long held that there is a stimulating substance in the oat grain. All claims of the discovery of this compound have, however, melted away on careful examination. . . . For dairy cows there is no better grain than oats, but the price of oats is often relatively high. Oats mixed with other concentrates are helpful in starting fattening cattle or sheep on feed. As fattening progresses more concentrated feeds are usually substituted for all or most of the oats because oats are much inferior to corn for fattening animals. Ground oats with the hulls sifted out provide a nourishing and wholesome feed for young calves and pigs."

Specifically in regard to hulless oats, Henry and Morrison say in "Feeds and Feeding," "A hulless oat but little known in this country serves well for poultry and swine, while the varieties with hulls are preferable for other stock."

Will Hulless Oats Stand Up as Well as Ordinary Varieties?

Whether hulless oats are to be produced for feeding directly to young stock on the farm or for sale, it is important that they shall not possess too great a tendency to lodge. In reply to an inquiry the following statement may be quoted

from Mr. Fowlds, who has observed strains of hulless oats in head-rows at Brookings in comparison with other varieties:

"The strength of straw in the different strains of hulless oats varies. The hulless variety from which the hulless selections have been developed has weak straw, and this character would naturally be transmitted to some of the selections. As a rule perhaps the hulless strains will not resist lodging quite so well as the hulled sorts."

The reply from Mr. Geo. J. Hasse, Warner, (Table II) stated that hulless oats in his field "stood up well."

ANNUAL RAINFALL

BROOKINGS

	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	0.22	0.17	1.06	0.26	1.20	1.07	0.61	0.28	0.02	0.22	0.18	1.47	1.54	0.19	0.07	0.34	0.09	0.40
February	2.90	0.02	0.28	1.80	1.57	0.40	0.[illegible]	0.24	0.09	0.40	1.12	0.32	0.47	0.14	0.63	0.24	0.05	1.73
March	0.68	0.58	0.55	1.16	0.37	0.35	0.53	0.26	0.45	0.42	0.18	0.50	1.09	0.44	0.73	1.85	1.49	0.79
April	1.61	1.40	1.67	2.10	1.16	2.34	1.62	3.36	2.24	1.64	2.03	2.95	3.09	1.28	1.90	2.95	1.42	0.42
May	6.13	3.51	2.36	6.46	4.85	0.87	1.90	6.98	3.60	4.16	2.12	3.72	3.08	3.40	3.87	3.84	2.99	1.82
June	6.09	4.89	5.65	6.35	2.29	1.85	3.87	2.09	1.96	6.67	3.28	4.27	3.49	1.85	9.30	7.27	0.85	3.75
July	0.98	1.86	3.77	4.69	2.44	1.68	3.32	2.52	2.99	1.62	3.04	0.40	2.03	3.95	5.60	5.45	3.44	2.81
August	4.24	4.28	1.41	2.37	3.39	2.46	3.81	4.68	1.33	3.16	3.52	2.03	1.20	4.19	1.48	2.15	2.11	1.70
September	2.16	5.13	1.28	3.89	1.67	0.96	3.08	1.61	1.55	3.32	2.68	0.84	2.89	0.72	1.69	1.99	4.25	0.36
October	1.19	3.01	0.96	1.43	1.71	0.38	5.12	0.96	1.18	2.21	1.37	0.45	0.12	1.56	1.14	0.66	0.27	0.81
November	2.45	0.89	0.10	1.30	0.65	0.17	0.23	0.00	0.81	T	0.28	0.03	0.04	1.61	1.35	1.30	0.50	3.08
December	T	0.52	1.12	0.42	1.14	0.10	0.42	0.20	0.09	0.33	0.62	0.36	0.31	1.09	0.10	0.30	0.10	0.20
Total	22.77	26.26	20.21	32.17	22.44	12.63	24.95	23.18	16.31	24.15	20.42	17.34	19.35	20.42	27.86	28.34	17.56	17.87

COTTONWOOD

	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	0.66	T	0.17	0.16	0.03	0.39	0.04	0.45	0.32	0.04	0.27	0.17	0.94
February	0.97	0.15	0.05	0.10	1.18	1.57	0.02	1.50	1.50	0.29	0.54	0.10	0.32
March	0.76	T	3.00	0.43	0.35	0.46	0.04	0.31	0.34	0.71	0.58	0.17	0.00
April	1.06	0.85	3.32	1.15	2.26	2.80	0.81	0.80	2.27	3.57	2.80	0.40	1.25
May	2.54	1.10	1.18	2.95	2.35	6.61	3.87	3.30	2.78	1.29	5.83	2.91	2.87
June	1.30	0.64	0.95	0.59	1.64	4.79	1.83	0.62	1.37	4.97	4.02	0.78	5.43
July	1.11	0.59	2.42	0.81	1.04	4.58	1.80	0.90	2.29	2.05	0.67	3.58	6.48
August	0.48	2.41	3.42	1.84	1.88	2.51	2.22	2.00	3.43	0.20	1.87	1.10	0.72
September	0.82	3.59	1.30	1.15	1.19	2.42	0.18	1.17	1.43	0.25	1.63	0.41	0.16
October	0.32	1.15	0.11	0.76	2.23	0.90	0.57	0.14	0.28	2.03	0.93	0.78	0.92
November	0.53	0.20	T	0.14	0.02	T	0.15	0.39	0.11	0.71	0.36	0.29	2.32
December	3.00	0.42	0.12	0.38	0.84	0.10	0.14	0.50	0.25	0.20	0.18	0.21	0.00
Total	12.65	11.10	16.04	10.46	15.28	27.31	11.67	12.08	16.37	16.31	19.68	10.90	21.41

EUREKA

	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	0.10	0.60	0.50	0.25	0.10	0.22	0.90	0.79	0.40	0.14	0.07	0.16	0.44	0.16
February	0.45	1.70	0.73	0.40	0.03	0.05	1.08	0.13	0.20	0.50	1.04	0.08	0.05	0.94
March	0.14	1.23	0.62	1.05	0.09	0.13	0.23	1.78	1.46	0.58	0.52	0.27	1.27	0.30
April	0.50	0.82	2.24	1.29	0.68	2.07	1.83	0.88	2.18	1.98	1.28	1.63	3.74	0.89
May	2.65	0.42	0.97	3.37	1.97	2.20	2.58	3.57	1.30	1.97	3.68	1.82	3.31	3.39
June	3.35	3.80	1.29	1.50	2.91	4.28	4.66	4.16	1.61	0.93	2.29	4.26	0.52	3.38
July	2.21	0.53	0.43	2.19	2.16	1.25	3.38	—	1.04	1.03	4.08	2.49	4.57	1.66
August	1.39	2.60	3.27	3.27	1.53	2.11	2.47	4.62	0.93	1.77	0.77	2.05	4.45	0.45
September	1.25	3.65	1.15	1.43	0.54	0.70	3.74	1.05	0.67	0.36	0.04	3.90	3.29	0.54
October	0.17	0.18	0.61	0.07	1.52	0.87	3.10	0.29	0.06	0.55	1.13	0.36	1.64	0.63
November	0.60	T	0.88	T	0.06	T	0.56	0.14	2.00	0.53	0.12	0.54	0.36	3.90
December	2.40	0.25	0.80	0.11	0.52	0.53	0.36	0.06	0.75	0.20	0.32	0.09	0.24	0.23
Total	15.21	15.78	13.79	14.93	12.11	14.41	24.89	17.47	12.60	10.54	12.62	16.42	23.88	16.47

HIGHMORE

	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	T	0.26	0.82	0.11	0.13	0.05	0.13	0.43	1.40	1.12	0.60	0.10	0.27	0.25	0.45
February	0.53	0.34	0.19	0.39	0.11	0.30	0.62	1.28	0.27	0.52	0.25	1.35	0.53	T	0.93
March	0.00	0.13	0.58	2.54	0.27	0.87	0.45	0.37	0.74	1.27	0.45	1.24	1.20	0.49	1.05
April	1.35	0.30	1.40	0.32	1.05	1.27	3.65	2.50	0.89	2.79	2.57	1.96	2.56	1.78	0.93
May	2.68	4.72	0.94	2.31	2.20	4.56	2.23	3.48	4.15	2.04	3.57	6.63	6.04	2.60	2.78
June	5.78	1.69	3.74	0.09	1.31	0.97	4.09	4.87	4.54	2.04	1.59	1.95	7.35	0.55	3.65
July	2.49	1.81	0.85	2.69	1.44	1.79	2.01	5.55	2.10	1.91	5.26	2.65	3.56	3.10	2.85
August	3.53	3.74	0.66	2.52	3.39	1.20	1.16	0.78	4.10	0.68	1.88	0.82	2.47	3.68	0.41
September	0.62	1.70	0.89	3.06	0.71	0.53	1.01	2.36	2.75	2.03	0.62	0.54	1.51	4.79	0.48
October	2.19	1.04	0.24	1.05	0.20	0.61	1.92	1.15	0.58	0.06	0.49	2.16	0.75	1.20	0.39
November	1.39	0.71	0.40	0.35	0.00	0.03	—	0.32	0.13	0.07	1.10	1.80	0.84	0.33	2.83
December	0.31	1.41	0.44	0.44	0.35	0.28	0.25	0.20	0.47	0.27	0.86	0.15	0.20	0.20	0.35
Total	28.87	17.85	9.05	15.87	12.00	12.46	17.52	23.29	22.12	14.80	19.24	21.35	27.08	18.97	17.10

VIVIAN

	1915	1916	1917	1918	1919	1920	1921	1922
January	0.50	1.00	1.35	1.10	—	—	0.19	0.47
February	1.77	0.04	0.18	0.50	0.32	0.58	0.01	0.40
March	1.19	0.29	1.00	0.50	0.66	1.52	0.68	0.75
April	2.62	1.08	2.38	3.92	4.14	4.55	1.53	0.71
May	3.02	3.46	5.20	3.33	3.23	7.51	4.23	2.49
June	4.31	4.49	1.18	1.70	5.01	5.54	1.22	5.85
July	6.76	3.53	1.02	2.07	4.00	3.42	4.34	3.44
August	1.12	3.52	2.01	3.32	0.94	1.86	0.44	3.86
September	3.16	0.90	2.64	0.75	1.70	0.80	3.55	0.27
October	1.12	0.57	0.00	0.82	1.95	2.09	1.68	0.45
November	0.38	0.12	—	0.22	1.91	1.32	0.63	2.32
December	0.03	0.04	0.32	0.90	0.13	0.28	0.28	0.15
Total	25.98	19.04	17.28	19.13	23.99	29.47	18.78	20.66

LIST OF AVAILABLE PUBLICATIONS

Circular No. 1, Nitrogen from the Air.

Annual Reports, 1917, 1918, 1919, 1920, 1921, 1922, 1923.

Bulletins

132. Effects of Alkali Water on Dairy Products.
147. Effect of Alkali Water on Dairy Cows.
158. Proso and Kaoliang for Table Use.
159. Progress in Plant Breeding.
161. Winter Grain in South Dakota.
162. First Annual Report of Vivian Experiment and Demonstration Farm.
164. Making Butter and Cheese on the Farm.
165. Corn Silage for Lambs.
166. Factors Affecting Milking Machines.
167. Transplanting Alfalfa.
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169. Flax Culture.
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206. Purebred Dairy Sires.

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