

U. S. DEPARTMENT OF AGRICULTURE  
WEATHER BUREAU

IN CO-OPERATION WITH THE

Iowa Weather and Crop Service

---

ANNUAL REPORT FOR 1916

---

GEO. M. CHAPPEL, M. D., Director

---

Published by  
THE STATE OF IOWA  
DES MOINES

LETTER OF TRANSMITTAL.

HON. W. L. HARDING, *Governor.*

SIR: In compliance with the requirements of the law, I have the honor to submit herewith the twenty-seventh annual report of the Iowa Weather and Crop Service, for the year 1916.

I have the honor also to submit an article by Dr. L. H. Pammel, relative to fungus diseases in Iowa for the year 1916, which I respectfully ask to have printed and embodied in this report.

GEO. M. CHAPPEL, M. D., *Director.*

Des Moines, January 24, 1917.

## ANNUAL REPORT 1916

### HISTORICAL DATA.

The Iowa Weather and Crop Service was established by an Act passed by the Twenty-third General Assembly, and approved by the Governor April 25, 1890.

The object of the Service is to cooperate with the U. S. Weather Bureau in collecting crop statistics and meteorological data, and more widely disseminate the weather forecasts and storm and frost warnings for the producers and shippers of perishable products, and to promote general knowledge of meteorological science and the climatology of the State.

In accordance with the Act, on the recommendation of the directors of the State Agricultural Society, J. R. Sage was duly commissioned by Governor Boies on June 3, 1890, and General Greeley, then Chief Signal Officer, U. S. Army, detailed Dr. George M. Chappel to serve as assistant director of the State Service. Mr. J. R. Sage resigned as director December 31, 1907, and Dr. George M. Chappel was commissioned on June 1, 1908, as director, and has since served in that capacity.

#### OFFICE FORCE, DECEMBER 31, 1916.

Geo. M. Chappel, M. D., Director.  
Charles D. Reed, M. S. A., Meteorologist and First Assistant.  
Ed. W. McGann and Carl E. Hadley, Assistants.  
Ruby C. Sage, Stenographer.  
Joseph E. Frankford, Messenger.

This report is issued so that the summaries of the monthly and weekly bulletins issued by the Iowa Weather and Crop Service, in co-operation with the Weather Bureau of the United States Department of Agriculture, may be put in shape for convenient reference and comparison with past and future years.

The regular meteorological, climatological and crop statistical work of the Service has been maintained and kept up to the high standard of efficiency of past years; more than the usual attention having been devoted to the accuracy of the reports and the exposure of instruments.

Twenty-four thousand copies of the monthly Climatological Reports, and 31,000 copies of the weekly Weather Crop Bulletins were issued and distributed during the year. Five hundred of the monthly reports are distributed each month through the Weather Bureau, U. S. Department of Agriculture to scientific institutions and libraries in this and foreign countries.

The daily weather forecasts were distributed by telegraph at the expense of the U. S. Weather Bureau to 82 towns, by franked mail to 1,985 addresses, by rural delivery to 934 addresses, and by free telephone to 114,132 subscribers. Preparation was made to have frost warnings sent, in case of necessity, during the fruit blooming season, to all orchardists in the state who were prepared to use orchard heaters in case of frost or injurious temperatures.

#### CLIMATOLOGY OF THE YEAR 1916

The year 1916 was slightly cooler and much drier than usual. The mean temperature was  $47.2^{\circ}$ , or  $0.2^{\circ}$  below the normal, and the average precipitation was 28.90 inches, or 3.7 inches less than the normal. There were, however, some unusually high temperatures and excessively heavy rainfall. The most marked features in this respect being the high temperatures in July and August, the lowest temperature of record for the first half of November and the excessive rainfall over the northeastern counties on June 1, a report of which was published in the Climatological Data for June. The summer, as a

whole, was droughty, and as a result the yield of all small grain was lessened, late potatoes were practically ruined and corn and pasturage were seriously damaged. The autumn was generally pleasant and corn husking began earlier than usual and was practically finished before the end of November.

**BAROMETER** (reduced to sea level)—The average pressure of the atmosphere for the year was 30.02 inches. The highest pressure was 30.83 inches, at Omaha, Neb., on January 13th and February 13th. The lowest pressure was 29.13 inches, at Keokuk, on March 21st. The range for the state was 1.70 inches.

**TEMPERATURE**—The mean temperature for the state was 47.2°, or 0.2° below the normal. The highest annual mean was 52.0°, at Keokuk, Lee county. The lowest annual mean was 42.2°, at Estherville, Emmet county. The highest temperature reported was 106°, at Webster City, on August 4th. The lowest temperature reported was -34°, at Inwood, on January 13th. The range for the state was 140°.

**PRECIPITATION**—The average amount of rainfall and melted snow for the year was 28.90 inches, or 3.07 inches less than the normal, and 10.63 inches less than the average for 1915. The greatest amount at any station was 46.34 inches, at Nora Springs, Floyd county, and the least amount was 22.21 inches, at Alta (near), Buena Vista county. Omaha, Neb., had only 19.46 inches. The greatest monthly precipitation was 10.44 inches, at Burlington, Des Moines county, in May. The least amount was 0.05 inch, at Osage in February, and at Matlock in November. The greatest amount in any 24 consecutive hours was 4.46 inches, at Cedar Rapids, on June 1st. Measurable precipitation occurred on an average of 90 days, 13 days less than in 1915.

**SNOWFALL**—The average amount of snowfall was 29.5 inches. The greatest amount reported from any station was 61.0 inches at Northwood, Worth county, and the least amount was 10.1 inches, at Lenox, Taylor county. The greatest monthly snowfall was 18.5 inches, at Rockwell City, Calhoun county, in January.

**WIND**—The prevailing direction of the wind was northwest. The highest velocity reported was 70 miles an hour from the southwest at Sioux City, Woodbury county, on August 6th.

**SUNSHINE AND CLOUDINESS**—The average number of clear days was 178; partly cloudy, 98; cloudy, 90; as against 144 clear days, 105 partly cloudy, and 116 cloudy days in 1915.

## MONTHLY SUMMARIES

### JANUARY.

From a climatological point of view, January, 1916, in Iowa was a month of much interest. While the average temperature for the whole state was almost exactly normal, this statement is inapplicable in particular except to a narrow strip extending north and south through the central portion. In the extreme western counties the month was much colder than usual, but was correspondingly mild at the opposite side of the state. Throughout the month sudden and marked variations in temperature were the rule rather than the exception, and cold waves were numerous. An extreme instance of a rapid and sudden change to colder occurred at Davenport on the 5th when the temperature fell from 55° to 1°. With reference to precipitation, the month established a new record by being decidedly the wettest of its name in the 27 years' climatological history of the Weather Bureau in Iowa. Every station in the state reported an excess of moisture, a fact in itself of note. A large percentage of the total precipitation was in the form of rain and sleet. The fall of sleet was the heaviest in years, amounting to about an inch in some districts and was reported somewhere in the state on more than half the days of the month. Moreover, several "ice" storms occurred and at one time the accumulated thickness of ice on trees and other exposed objects averaged three-tenths of an inch. Telegraph, telephone and lighting companies suffered severely in some sections, but as a whole the losses were not so heavy as might have been expected.

The two most striking features of the month were the cold wave of the 12th-13th and a series of sleet and ice storms covering the 25th-29th. The cold wave was one of the severest in recent years and, generally speaking, the minimum temperatures reached were the lowest since the memorable January of 1912. The 12th was one of the most inclement days experienced in years, the conditions closely approaching those of a typical blizzard. Transportation interests were seriously affected, especially trolley service. In some cases business houses closed early in order that employes might be assured of reaching their homes. On the following morning the temperatures ranged from -17° at Keokuk, to -34° at Inwood. The sleet and ice storms already referred to culminated on the 28th and 29th in a fall of rain at temperatures below freezing. Up to that time the several accretions of sleet had formed a mass varying from half an inch to an inch in thickness and this was converted by the freezing rain practically into a layer of ice that covered the entire landscape. Walking became a most difficult undertaking, and accidents as the result of falls occurred by the hundred. In Des Moines the unusual spectacle was witnessed of skating on the golf links and in country districts men skated from farms to town. A fall of snow soon ended the

skating but served to greatly relieve the icy conditions underfoot. There was some apprehension as to the effect the ice sheet might have on winter wheat and meadows. While the matter is problematical, it is thought that where the fields are short and the ice lies close to the ground much wheat and some grass will be smothered.

*Pressure.*—The mean pressure (reduced to sea level) for the state was 29.17 inches. The highest record was 29.86 inches, at Sioux City, on the 13th, and the lowest was 29.36, at the same station, on the 9th. The monthly range was 1.50 inches.

*Temperature.*—The mean temperature for the state, as shown by the records of 197 stations, was 17.8°, or only 0.1° lower than the normal. By divisions, three tiers of counties to the division, the means were as follows: Northern, 13.5°, or 1.1° lower than the normal; Central, 18.4°, or 0.2° higher than the normal; Southern, 21.5°, or 0.6° higher than the normal. The highest monthly mean was 27.0°, at Keokuk, and the lowest monthly mean was 4.6, at Rock Rapids. The usual January difference in mean temperature between these stations is about 10°. The highest temperature reported was 63°, at Leon, on the 1st, and the lowest temperature reported was -34°, at Inwood on the 13th. The latter is the lowest temperature reported in Iowa since January 12, 1912. The temperature range for the state was 97°.

*Humidity.*—The average relative humidity for the state at 7 a. m. was 83.7 per cent, and at 7 p. m. it was 80.1 per cent. The mean for the month was 81.9 per cent, or about 0.9 per cent greater than the normal. The highest monthly mean was 88 per cent at Charles City, and the least was 79.5 at Keokuk.

*Precipitation.*—The average precipitation for the state, as shown by the records of 111 stations, was 2.62 inches, or 1.59 inches more than the normal. By divisions the averages were as follows: Northern, 2.09, or 1.25 inches more than the normal; Central, 2.70 inches, or 1.59 inches more than the normal; Southern, 3.07 inches, or 1.88 inches more than the normal. The greatest amount, 6.07 inches, occurred at Mt. Pleasant, and the least, 0.85 inch, at Lake Park. The greatest amount in any 24 consecutive hours, 1.92 inches, occurred at Ft. Madison, on the 19th.

*Snow.*—The average snowfall for the state was 7.2 inches, or about the normal amount. The greatest amount, 18.5 inches, occurred at Rockwell City, and the least, 1.3 inches, at Centerville.

*Wind.*—The prevailing direction of the wind was from the northwest. The highest velocity reported from a regular Weather Bureau station was at the rate of 50 miles an hour from the northwest, at Sioux City, on the 27th.

*Sunshine and Cloudiness.*—The average percentage of the possible amount of sunshine was 45, or about 4 per cent lower than the normal. The percentage of the possible amount at the several regular Weather Bureau stations being as follows: Charles City, 36; Davenport, 43;

Des Moines, 46; Dubuque, 49; Keokuk, 40; Omaha, Nebr., 49; Sioux City, 51.

*Rivers.*—Heavy rains in the Davenport district on the 20th caused the flooding of creeks and smaller streams. Continued mild weather and further heavy rain on the 26th resulted in rapidly rising stages in the Mississippi, from Le Claire to Muscatine, and the breaking up of the ice at Davenport on the night of the 24th-25th. At that place the ice became gorged below the city, causing a stage of 14.2 feet on the 25th which resulted in the flooding of cellars along the river front with seep water.

*Miscellaneous Phenomena.*—Thunderstorms occurred over the southeastern counties on the 1st, 20th, 21st and 29th. Sleet occurred on the 1st, 9th, 10th, 11th, 12th, 18th, 19th, 20th, 21st, 24th, 25th, 26th, 27th, 28th, 29th, 30th and 31st. Ice harvest began in the larger streams about the 17th, but was not completed owing to rains and mild weather.

*Severe Cold Wave of January 12th-14th, 1916, at Dubuque.*—By J. H. Spencer, Local Forecaster. This cold wave was the severest of the winter to date, and one of the severest in years. Temperature at Dubuque fell 49° during the 24 hours ending at 7 a. m. of the 13th, 22° below zero being recorded at that hour. The maximum of the 13th was 12° below zero. During the night of the 13th-14th the temperature remained nearly stationary at 15° below zero, but 17° below was recorded at 8:30 a. m. of the 14th.

On the afternoon and evening of the 12th a blinding snow storm occurred, accompanied by high winds and rapidly falling temperature. These conditions caused a partial tieup of local street railway traffic and considerable delay in trains on all the railroads of this section. On the 13th railroad traffic was much interfered with, due to the extreme cold, and some trains were many hours late. On the whole, however, conditions were not bad, and losses were small.

Telegraph and telephone companies experienced very little trouble in this immediate section, but between Freeport, Ill., and Chicago, wires were taken down by sleet on the night of the 12th.

Warnings were given well in advance of the cold wave, and were generally heeded. Railroads, express companies, business houses, etc., prepared for the severe cold, perishable shipments were refused, and losses were reduced to a minimum.

## COMPARATIVE DATA FOR THE STATE—JANUARY.

YEAR	Temperature				Precipitation			Number of Days					
	Mean	Departure	Highest	Lowest	Total	Departure	Greatest	Least	Snow fall	With precipi- tation, .01 in.	Clear	Partly cloudy	Cloudy
1800	19.7	+1.8	61	-27	2.03	+0.98	8.46	0.35					
1801	20.0	+1.8	38	-4	1.75	+0.70	3.90	0.61					
1802	15.2	-2.6	76	-38	1.00	+0.04	3.13	0.10	6.9	5	16	7	11
1803	9.3	-8.6	54	-34	0.74	-0.31	3.20	0.13	6.9	6	11	9	21
1804	19.3	+1.4	69	-37	1.09	+0.04	2.24	0.31	6.0	5	14	9	8
1805	12.6	-4.3	68	-31	0.85	-0.20	2.65	0.09	8.7	4	15	7	9
1806	22.4	+5.6	68	-20	0.48	-0.57	2.50	T.	2.8	8	10	10	11
1807	17.2	-0.7	66	-30	2.01	+0.96	6.16	0.15	8.2	7	12	7	12
1808	23.4	+5.6	52	-11	1.90	+0.55	5.32	T.	12.9	6	15	6	19
1809	19.8	+1.9	68	-34	0.78	-0.77	1.15	T.	1.5	15	10	6	
1800	25.0	+7.7	60	-20	0.33	-0.32	2.47	T.	2.3	16	7	8	
1801	22.7	+5.8	60	-21	0.74	-0.31	2.54	0.04	6.2	4	14	9	8
1802	22.4	+4.5	63	-13	0.88	-0.17	2.83	0.19	9.4	4	17	8	11
1803	23.0	+5.1	60	-12	0.28	-0.77	1.46	T.	2.0	4	13	7	16
1804	14.0	-6.9	67	-32	1.18	+0.13	3.68	0.62	6.1	12	6	6	11
1805	11.3	-9.7	56	-30	0.91	-0.14	3.82	0.12	11.1	7	14	7	10
1806	24.6	+6.7	60	-19	1.92	+0.47	4.71	0.28	11.2	5	14	6	11
1807	18.8	+0.9	68	-22	1.52	+0.47	5.50	0.10	6.0	7	8	7	16
1808	24.9	+7.0	60	-18	0.44	-0.61	1.50	0.04	4.6	2	17	8	6
1809	21.2	+3.3	72	-25	1.68	+0.61	3.74	0.41	7.8	6	9	6	16
1810	18.1	+0.2	56	-35	1.57	+0.92	3.15	0.55	12.6	6	13	7	11
1811	20.2	+2.3	66	-35	0.97	-0.08	3.73	0.11	7.3	5	6	8	14
1812	4.2	-13.7	49	-47	0.33	-0.52	1.90	T.	5.5	5	14	7	10
1813	20.9	+3.0	62	-25	0.77	-0.28	2.63	0.04	7.3	5	11	9	12
1814	27.8	+9.9	64	-10	0.88	-0.17	2.34	0.27	5.1	5	11	8	12
1815	17.5	-0.4	50	-32	1.63	+0.58	3.15	0.10	7.3	8	12	8	10
1816	17.8	-0.1	63	-34	2.02	+1.97	6.07	0.85	7.3	10	12	6	13

T indicates an amount too small to measure, or less than .003 inch precipitation, and less than .05 inch snowfall.

## FEBRUARY.

Despite the fact that the weather was colder than usual, February, 1916, must be classed with the more pleasant and favorable months of that name which are of record for Iowa. A predominance of fair, sunny weather, together with an absence both of marked fluctuations in temperature and high winds contributed the features that gave the month the characteristics mentioned above. The month's coldness was almost entirely the result of persistent low temperature during the first two weeks. During that period freezing weather prevailed both day and night throughout practically the whole state. On several mornings the readings were below zero, but, except in the extreme northwestern counties, no abnormally low temperatures occurred. The most pleasant part of the month comprised the ten-day period beginning on the 15th. During that time the temperature was almost continuously above the normal and fair weather was practically unbroken. However, rain and snow fell on Washington's birthday, in the central counties. Rapid melting of snow and ice took place during this mild period, causing high water in streams. In some cases ice jams damaged bridges and caused flooding of lowlands.

So far as is known the winter's ice sheet has caused no material damage to winter wheat and meadows.

**Pressure.**—The mean pressure (reduced to sea level) for the state was 30.23 inches. The highest recorded was 30.86 inches; at Sioux City, on the 13th, and the lowest was 29.69, at Davenport, on the 26th. The monthly range was 1.17 inches.

**Temperature.**—The mean temperature for the state, as shown by the records of 105 stations, was 19.0°, or 1.5° lower than the normal. By divisions, three tiers of counties to the division, the means were as follows: Northern, 15.1°, or 2.0° lower than the normal; Central, 19.4°, or 1.3° lower than the normal; Southern, 22.5°, or 1.1° lower than the normal. The highest monthly mean was 25.6°, at Keokuk, and the lowest monthly mean was 11.6°, at Estherville. The highest temperature reported was 61°, at Sioux City, on the 19th, and the lowest temperature reported was -32°, at Rock Rapids, on the 2d. The latter is the lowest temperature reported in February since 1906. The temperature range for the state was 93°.

**Humidity.**—The average relative humidity for the state at 7 a. m. was 85.4 per cent, and at 7 p. m. it was 77.7 per cent. The mean for the month was 81.6 per cent, or about 2.4 per cent higher than the normal. The highest monthly mean was 87.5 per cent, at Charles City, and the lowest was 78.4, at Omaha, Nebr.

**Precipitation.**—The average precipitation for the state, as shown by the records of 111 stations, was 0.55 inch, or 0.60 inch less than the normal. By divisions the averages were as follows: Northern, 0.57 inch, or 0.34 inch less than the normal; Central, 0.62 inch, or 0.58 inch less than the normal. Southern, 0.46 inch, or 0.89 inch less than the normal. The greatest amount, 1.38 inches, occurred at Nora Springs, and the least, 0.05 inch, at Osage. These stations are in adjoining counties. The greatest amount in any 24 consecutive hours, 1.15 inches, occurred at Nora Springs, on the 4th.

**Snowfall.**—The average snowfall for the state was 6.0 inches, or 1.4 inches less than the normal. The greatest amount, 12.0 inches, occurred at Allison, and the least, 0.5 inch, at Osage.

**Wind.**—The prevailing direction of the wind was from the northwest. The highest velocity reported from a regular Weather Bureau station was at the rate of 44 miles an hour from the northwest, this occurring at Sioux City, on the 26th.

**Sunshine and Cloudiness.**—The average per cent of the possible amount of sunshine was 60, or about 4 per cent higher than the normal. The per cent of the possible amount at the regular Weather Bureau stations was as follows: Charles City, 48; Davenport, 59; Des Moines, 64; Dubuque, 66; Keokuk, 55; Sioux City, 65; Omaha, Nebr., 63.

**Rivers.**—The Mississippi at Davenport was at flood stage for several hours on the 2d but a falling stage set in before serious damage occurred.

At Dubuque the river was frozen all the month, the ice there ranging in thickness from 12 to 17 inches. During the last week of the month the ice in places broke away from the shore and moved down stream a short distance, but there was no general breakup.

*Miscellaneous Phenomena.*—The only thunderstorm of the month was reported on the 22d from four stations in the eastern part of the state. Sleet occurred on the 9th, 10th, 11th, 12th, 22nd and 26th. Halos, either lunar or solar, were reported on the 1st, 2d, 3d, 4th, 5th, 7th, 8th, 9th, 10th, 12th, 14th, 15th, 17th, 27th and 29th. Fog occurred on the 1st, 2d, 9th, 10th, 11th, 15th, 17th, 20th, 21st and 22d. The first appearance of robins was on the 18th, at Columbus Junction.

## COMPARATIVE DATA FOR THE STATE—FEBRUARY.

YEAR	Temperature				Precipitation				Number of Days					
	Mean	Departure	Highest	Lowest	Total	Departure	Greatest	Least	Snow fall	With pre. of 1/2 in. or more	Clear	Partly cloudy	Cloudy	
1890	26.0	+5.5	67	-34	0.83	-0.22	2.18	0.11	-----	-----	9	13	7	8
1891	19.4	-1.1	79	-31	1.15	+0.11	2.41	0.55	-----	6.0	6	10	7	8
1892	25.1	+7.6	68	-20	1.29	+0.15	2.18	0.12	-----	8.1	6	10	8	10
1893	16.4	-4.1	60	-28	1.39	+0.34	2.91	0.95	-----	8.1	6	10	8	10
1894	19.7	-0.8	80	-19	0.89	-0.16	2.41	T 8.4	-----	5	6	10	8	4
1895	16.4	-4.1	73	-33	0.49	-0.56	1.34	0.02	3.3	4	13	9	6	6
1896	27.4	+6.9	78	-13	0.71	-0.34	2.60	0.94	5.4	4	12	9	8	8
1897	24.7	+4.2	61	-24	0.89	-0.16	1.81	0.22	8.0	5	6	10	12	7
1898	24.2	+3.7	62	-18	1.20	+0.15	3.65	0.10	7.8	5	10	9	9	9
1899	12.2	-8.3	75	-40	0.80	-0.16	4.32	0.12	7.1	5	11	10	7	7
1900	14.8	-5.7	69	-27	1.30	+0.25	4.07	0.18	9.9	6	10	8	10	8
1901	17.5	-3.0	49	-21	1.01	-0.94	3.00	0.12	9.7	4	15	7	6	6
1902	17.6	-2.9	62	-21	0.73	-0.32	2.39	0.02	2.6	4	13	8	7	8
1903	19.8	-0.7	56	-21	1.19	+0.15	3.25	0.30	7.9	4	13	7	8	8
1904	14.8	-5.7	70	-26	0.41	-0.64	1.99	T 4.5	4	10	9	10	8	8
1905	24.7	+4.2	69	-11	1.37	+0.52	2.97	0.44	15.5	7	14	6	8	8
1906	23.6	+3.1	66	-32	1.29	+0.34	2.91	0.20	6.1	5	14	7	7	8
1907	25.0	+4.5	65	-31	0.71	-0.34	1.95	0.06	4.6	4	14	6	8	8
1908	24.3	+3.8	59	-16	1.09	+0.54	2.95	0.22	8.9	6	13	6	11	11
1909	26.2	+5.7	62	-28	1.54	+0.49	4.72	0.30	7.7	5	11	6	11	11
1910	17.8	-2.7	58	-21	0.68	-0.59	2.09	T 4.0	3	14	8	8	8	8
1911	27.3	+6.8	71	-13	2.78	+1.71	5.48	0.50	7.0	6	12	8	10	10
1912	18.1	-2.4	57	-30	1.31	+0.16	2.25	0.94	11.2	5	10	9	10	10
1913	20.8	+0.3	70	-24	0.82	-0.23	2.39	0.07	7.3	4	14	7	7	7
1914	16.8	-3.7	59	-29	0.87	-0.18	1.99	0.32	9.2	6	10	9	9	9
1915	29.1	+8.6	62	- 8	2.93	+1.88	5.39	0.43	9.4	9	9	5	14	14
1916	19.0	-1.5	62	-32	0.56	-0.60	1.38	0.05	6.0	4	14	8	7	7

T indicates an amount too small to measure, or less than .005 inch precipitation, and less than .35 inch snowfall.

## MARCH.

Viewing the state as a whole, the first spring month of 1915 in Iowa was somewhat milder and drier than usual. Over certain portions of the state, however, there were wide departures from these average conditions. In the counties bordering on the Mississippi River the month was little if any milder than the average March, but thence westward across the state the excess of mean temperature showed a progressive

increase until at the Missouri River it amounted to an average of 4° a day. The area of deficient precipitation included all except the southeastern and extreme eastern counties; but over parts of the districts named occurred the heaviest March precipitation of record.

The special features of the month were the unseasonably high temperatures on the 12th over the southern half of the state, a six-day period of heavy precipitation over the southeast and extreme east and the storm of the 21st-22d. At Des Moines the temperature on the 12th rose to a higher degree (77°) than ever previously reached so early in the season. The period of heavy precipitation referred to extended from the 21st to the 26th, inclusive. The fall at Washington during that time amounted to 5.56 inches, or all but 0.24 of an inch of the month's total at that station. On the 26th the rainfall there was 4.41 inches, which compares with the heaviest 24-hour amounts liable to occur at any time of the year in Iowa. At Dubuque the precipitation for this period was 3.73 inches, or more than has occurred at that station during any entire March in 39 years. The storm of the 21st-22d in the eastern part of the state was characterized by heavy snow and a thunderstorm of much intensity. Loud thunder and sharp lightning occurred simultaneously with the fall of snow.

The warm weather early in the month started grass to growing, so that by the close some lawns were almost ready for mowing in southern sections. Spring seeding began in southern Iowa except over the wet sections of the southeast, but in the northern part of the state no field work was done. While some reports are conflicting as to the condition of fall-sown grains, there now appears no doubt but that in some sections serious damage has occurred owing to winter killing.

*Pressure.*—The mean pressure (reduced to sea level) for the state was 29.59 inches. The highest recorded was 30.56 inches, at Keokuk and Sioux City, on the 15th, and the lowest was 29.16 inches, at Davenport, on the 6th. The monthly range was 1.40 inches.

*Temperature.*—The mean temperature for the state, as shown by the records of 104 stations, was 35.2°, or 1.9° higher than the normal. By divisions, three tiers of counties to the division, the means were as follows: Northern, 31.6°, or 1.1° higher than the normal; Central, 35.4°, or 1.8° higher than the normal; Southern, 38.5°, or 2.5° higher than the normal. The highest monthly mean was 41.8°, at Northboro, a station in the extreme southwestern part of the state, and the lowest monthly mean was 27.8°, at Estherville, in the northwest and near the Minnesota boundary. The highest temperature reported was 80°, at Clarinda, on the 12th; this is about the average highest temperature that occurs during March in Iowa. The lowest temperature reported was -18°, at Algona, on the 2d. On the average a temperature as low as 18° below zero in March is experienced about every 5th year in this state.

*Humidity.*—The average relative humidity for the state at 7 a. m. was 82.3 per cent, and at 7 p. m. it was 65.3 per cent. The mean for the month was 72.9 per cent, or about 0.4 per cent lower than the normal. The high-

est monthly mean was 81.0 per cent, at Charles City, and the lowest was 67.2, at Omaha, Nebr.

**Precipitation.**—The average precipitation for the state, as shown by the records of 110 stations, was 1.57 inches, or 0.20 of an inch less than the normal. By divisions the averages were as follows: Northern, 1.23 inches, or 0.25 of an inch less than the normal; Central, 1.45 inches, or 0.42 of an inch less than the normal; Southern, 1.97 inches, or 0.05 of an inch more than the normal. The greatest amount, 5.80 inches, occurred at Washington, and the least, 0.23 of an inch, at Northboro. The greatest amount in any 24 consecutive hours, 4.41 inches, occurred at Washington, on the 26th.

The average snowfall for the state was 2.9 inches, or 2.5 inches less than the normal. The greatest amount, 10.0 inches, occurred at Elkader and Forest City, and the least, a trace, at 5 stations.

**Wind.**—The prevailing direction of the wind was from the northwest. The highest velocity reported from a regular Weather Bureau station was at the rate of 58 miles an hour from the northwest, this occurring at Sioux City, on the 6th.

**Sunshine and Cloudiness.**—The average per cent of the possible amount of sunshine was 58, or about 4 per cent higher than the normal. The per cent of possible amount at the regular Weather Bureau stations was as follows: Charles City, 41; Davenport, 57; Des Moines, 63; Dubuque, 59; Keokuk, 60; Sioux City, 58; Omaha, Nebr., 65.

**Miscellaneous Phenomena.**—Auroras were observed on the 6th, 7th, 8th, 9th, 10th and 23d. Thunderstorms occurred on the 21st, 22d, 23d, 24th, 25th, 26th, 30th and 31st. Fog was noted on the 1st, 6th, 7th, 9th, 12th, 13th, 25th, 26th, 29th and 30th. Sleet occurred on the 5th, 6th, 11th, 19th, 22d, 24th, 25th and 26th. On the 24th the atmosphere had a smoky appearance.

**Rivers.**—As a result of the six-day period of heavy precipitation covering the 21st to the 26th the Mississippi at Dubuque rose five and one-half feet in three days, reaching a maximum stage of 12 feet on the morning of the 27th; this is an exceptional rise for the length of time. All small streams, as well, in northeastern Iowa were at flood stage on the 25th and 26th. In the Davenport district the Mississippi rose rapidly as a result of the heavy rains on the 25th and 26th. The crest of the rise reached Davenport on the 29th, with a stage of 12.4 feet, and Muscatine on the 31st, with a stage of 14.8 feet. In Keokuk district the Mississippi and its tributaries, including the lower Des Moines River, reached the flood stage after the 27th, and unprotected lowlands were flooded by the 29th.

## COMPARATIVE DATA FOR THE STATE—MARCH.

YEAR	Temperature					Precipitation				Number of Days			
	Mean	Departure	Highest	Lowest	Total	Departure	Greatest	Least	Snow fall	With precipi- tation, in.	Clear	Partly cloudy	Cloudy
1900	38.0	-5.3	75	-54	1.57	-0.20	3.67	0.33	---	10	1	8	17
1901	36.8	-6.5	69	-19	2.09	+0.83	4.58	1.33	---	11	2	8	19
1902	31.9	-1.4	84	-6	2.22	+0.65	4.98	0.37	8.9	6	11	8	23
1903	31.8	-1.5	84	-6	2.14	+0.37	4.40	0.64	4.0	8	9	11	21
1904	41.0	+7.7	84	-6	2.02	+0.58	4.32	0.39	1.7	7	10	10	19
1905	34.4	+1.1	94	-11	1.83	-0.94	2.00	0.22	2.9	4	16	8	7
1906	30.9	-2.4	81	-12	1.10	-0.67	3.99	0.16	6.4	5	12	9	20
1907	25.0	-1.3	72	-20	1.29	+0.62	6.16	0.29	5.5	8	9	8	24
1908	37.6	+4.3	84	-2	1.94	+0.17	8.21	0.23	3.7	6	12	9	20
1909	32.0	-10.3	75	-16	1.62	-0.15	5.90	0.87	8.0	6	7	12	12
1900	30.7	-2.6	81	-13	2.06	+0.29	5.15	0.48	6.6	5	12	9	20
1911	34.3	+0.9	78	-8	2.64	+0.87	5.25	0.75	15.6	7	10	8	18
1912	31.1	-5.5	79	-13	1.45	-0.32	4.33	0.33	1.7	9	11	11	21
1913	38.8	+5.9	89	6	1.38	-0.39	3.90	0.15	5.9	7	11	7	18
1914	34.8	+1.6	78	8	2.13	+0.41	4.57	0.50	4.4	7	8	8	15
1915	31.5	-8.3	84	-1	2.04	+0.37	3.70	0.20	4.1	7	8	8	15
1916	27.1	-6.2	85	-14	2.34	+0.37	4.53	0.09	8.9	10	8	7	20
1917	40.6	+7.3	92	-7	1.35	-0.43	5.05	0.33	4.1	6	14	7	19
1918	37.9	+4.6	88	-8	1.28	-0.19	3.74	0.45	1.1	6	13	7	21
1919	32.5	-3.3	71	-15	1.52	-0.24	5.00	0.23	9.8	6	12	10	9
1920	48.9	+15.6	92	-10	0.17	-1.00	1.32	0.20	T	1	23	6	2
1921	30.4	+0.1	83	3	0.98	-0.84	4.84	T	1.9	5	16	9	6
1922	24.9	-8.4	79	-19	2.01	+0.24	5.55	0.00	19.1	7	15	6	19
1923	31.9	-1.4	78	-23	2.48	+0.71	5.58	0.74	5.8	9	11	10	19
1924	36.7	+1.4	78	-5	1.69	-0.09	3.84	0.38	1.8	7	12	8	14
1925	29.3	-4.0	61	-6	0.90	-0.81	2.12	0.17	8.8	5	8	9	11
1926	35.2	+1.9	80	-18	1.97	-0.20	5.80	0.33	2.9	6	11	9	11

T indicates an amount too small to measure, or less than .005 inch precipitation, and less than .05 inch snowfall.

## APRIL

April, 1916, in Iowa was cold, cloudy and showery, and as respects the growth of vegetation, backward. At the close of the month the season was from one to two weeks late. Although the temperature did not average more than 2° below the normal, this deficiency would have been doubled had not warm weather prevailed from the 11th to 13th, inclusive, and on the 19th. The latter half of the month was almost continuously cooler than usual, which fact doubtless accounts for the prevalent impression that the deficiency of temperature was greater than it proved to be.

Showers, generally light in character, were numerous throughout the month, but the latter half was especially marked in this respect. Only on the 2d was no precipitation reported from some part of the state. The rain of the 29th-30th was the most general heavy fall of the month, and owing to its slow, steady character, was of much benefit to small grain, grass and gardens. The persistent cool weather retarded the growth of vegetation and checked the development of fruit buds, but the showery weather did not greatly delay farming operations. The close of the month found oats seeding unfinished in parts of the northern division of the state, yet on the other hand some preparation of ground for corn had been completed. In southern counties corn planting was in progress.



At this time fruit trees were beginning to bloom and trees were leafing out as far north as central Iowa.

On the evening of the 19th the north-central part of the state was visited by a severe wind, rain and electrical storm. In Wright County the disturbance assumed tornadoic character, houses being moved from their foundations and otherwise damaged, while a number of outbuildings were destroyed. Hail accompanied the storm, some of the stones measuring an inch in diameter, and the ground was covered to a depth of eight-tenths of an inch. Fruit trees were severely injured by the hail. No persons are known to have been killed as a result of this storm.

*Pressure.*—The mean pressure (reduced to sea level) for the state was 29.98 inches. The highest recorded was 30.44 inches, at Sioux City, on the 6th, and the lowest was 29.33, at Des Moines and Sioux City, on the 19th. The monthly range was 1.11 inches.

*Temperature.*—The mean temperature for the state, as shown by the records of 105 stations, was 47.1°, or 1.6° lower than the normal. By divisions, three tiers of counties to the division, the means were as follows: Northern, 45.1°, or 1.6° lower than the normal; Central, 47.5°, or 1.4° lower than the normal; Southern, 48.8°, or 1.8° lower than the normal. The highest monthly mean was 50.8°, at Keokuk, and the lowest was 42.4°, at Estherville. The highest temperature reported was 90°, at Clarinda and Northboro, on the 12th, and the lowest was 11°, at Matlock, on the 6th. The latter is a recently opened station in Sioux County, in the extreme northwestern part of the state. The temperature range for the state was 79°.

*Humidity.*—The average relative humidity for the state at 7 a. m. was 78 per cent, and at 7 p. m. it was 58 per cent. The mean for the month was 68 per cent, or practically the normal. The highest monthly mean was 75 per cent, at Charles City, and the lowest was 64 per cent, at Dubuque.

*Precipitation.*—The average precipitation for the state as shown by the records of 113 stations, was 2.62 inches, or 0.24 of an inch less than the normal. By divisions the averages were as follows: Northern, 2.94 inches, or 0.26 of an inch more than the normal; Central, 2.38 inches, or 0.48 of an inch less than the normal; Southern, 2.54 inches, or 0.51 of an inch less than the normal. The greatest amount, 5.92 inches, occurred at Nora Springs, and the least was 1.13 inches, at Sioux City. The greatest amount in any 24 consecutive hours, 2.00 inches, occurred at Belmond, on the 19th.

*Snowfall.*—The average snowfall for the state was 1.1 inches, or 0.1 of an inch less than the normal. The greatest amount, 6.0 inches, occurred at Rockwell City, while 7 stations reported none whatever.

*Wind.*—The prevailing direction of the wind was from the northwest. The highest velocity reported from a regular Weather Bureau station was 48 miles an hour from the northwest, at Sioux City, on the 16th.

*Sunshine and Cloudiness.*—The average percent of the possible amount of sunshine was 55, or about 4 per cent lower than the normal. The percent of the possible amount at the regular Weather Bureau stations was as follows: Charles City, 43; Davenport, 61; Des Moines, 55; Dubuque, 56; Keokuk, 56; Sioux City, 54; Omaha, Nebr., 48.

*Miscellaneous Phenomena.*—Dates of: Auroras, 5th, 25th, 27th, 28th; Hail, 4th, 16th, 18th, 19th, 20th, 25th, 26th; Sleet, 3d, 21st, 26th; Thunderstorms, 13th, 14th, 15th, 16th, 18th, 19th, 20th, 25th, 28th, 29th.

*Flood at Dubuque, Iowa.*—By James H. Spencer, Meteorologist, U. S. Weather Bureau. Melting snows in northern Minnesota caused an exceptional rise in the Upper Mississippi during the first half of the month—at Dubuque from 10.4 feet on the 1st to 18.1 feet on the 14th; this was highest water in this section since 1888, exceeding the stage of 1897 by 0.2 of a foot. Losses were small as compared to the flood later in the month, but probably aggregated \$75,000 to \$100,000, and were divided about equally as follows: Damage to railroad property (among other damage two engines toppled into the water as the result of a weakened track); losses to mills and factories that were obliged to close down; damage to highways. Some hay in stack, farm machinery, and other property were swept away.

This flood crest had hardly passed down the Mississippi when a slow-moving Southwest Low advanced to the Upper Lake Region giving a period of heavy rains in Wisconsin, and causing floods in most of the rivers of northern Wisconsin; rains were heaviest on the 20th-21st. With the Mississippi River already very high at the time these rains occurred, the flood that resulted when crests from Wisconsin rivers reached the Mississippi were the worst since 1888, with the maximum stage at Dubuque 19.8 feet, or 1.7 feet higher than was recorded earlier in the month. A few factories and mills were compelled to close down, many factories and business houses sustained more or less loss although they did not have to close, railroads were heavy losers, many families were driven from their homes, and thousands of acres of farm lands were under water. Losses cannot be estimated at the present time, but it hardly seems probable that lowlands can be planted this year; if not, losses will aggregate several hundred thousand dollars.

*High Water at Davenport, Iowa.*—By J. M. Sherier, Meteorologist, U. S. Weather Bureau. High stages in the Mississippi prevailed throughout the month in the Davenport river district. At Clinton, Iowa, the highest stage was 16.4, on the 17th; at Le Claire, Iowa, 11.0 feet, on the 17th; at Davenport, 14.5 feet, on the 17th, and at Muscatine, Iowa, 16.3 feet, on the 18th and 19th. About the middle of April a break occurred in a private levee near Princeton, Iowa, and 1,000 acres of fertile agricultural land was flooded. It is thought that it will be impracticable to plant any crops in those fields during the present season.

## COMPARATIVE DATA FOR THE STATE—APRIL.

YEAR	Temperature				Precipitation				Number of Days				
	Mean	Departure	Highest	Lowest	Total	Departure	Greatest	Least	Snow fall	With precipi- tation, .01 in.	Clear	Partly cloudy	Cloudy
1890	51.8	+3.1	88	2	1.80	-1.06	4.46	0.38	-----	6	14	7	7
1891	50.6	+1.9	93	13	2.15	-0.71	6.06	0.99	-----	8	24	9	7
1892	45.4	-3.3	88	14	4.75	+1.89	8.38	2.43	-----	5.7	9	8	9
1893	45.5	-3.2	96	15	4.21	+1.35	8.51	1.24	-----	6.0	10	8	9
1894	51.7	+1.0	93	12	3.07	+0.21	6.31	0.55	-----	6.2	9	11	11
1895	54.2	+3.5	98	8	2.62	-0.24	5.88	0.28	-----	2.1	5	14	8
1896	54.5	+3.8	94	10	5.02	+2.16	9.67	2.35	-----	4.5	11	11	10
1897	47.9	-0.8	89	19	5.35	+2.49	9.86	2.22	-----	7	11	9	12
1898	48.1	-0.6	91	14	2.56	-0.39	4.82	0.27	-----	8	15	9	9
1899	48.9	+0.2	89	1	2.40	-0.46	5.76	0.56	-----	2.0	12	11	7
1900	52.2	+3.5	89	19	2.67	-0.21	6.62	0.43	-----	0.9	6	12	9
1901	49.9	+1.2	92	15	1.79	-1.07	3.47	0.66	-----	2.9	5	14	8
1902	48.2	+0.5	96	9	1.71	-1.15	4.15	0.49	-----	5	14	11	6
1903	49.8	+1.1	86	17	2.98	+0.12	6.00	0.74	-----	0.8	9	11	10
1904	44.1	-4.6	86	13	3.63	+0.77	8.97	1.52	-----	1.4	7	10	6
1905	47.5	-1.2	90	10	2.65	+0.17	5.49	0.63	-----	1.2	8	12	8
1906	52.5	+3.8	94	22	2.42	-0.34	6.55	0.33	-----	0.3	8	14	7
1907	41.5	-7.2	80	10	1.32	-1.54	3.22	0.24	-----	2.7	6	12	8
1908	50.5	+1.8	91	8	3.24	-0.62	4.69	0.67	-----	0.2	8	14	8
1909	45.8	-1.5	86	14	4.38	+1.72	9.43	0.83	-----	3.1	12	9	12
1910	52.5	+3.8	99	15	1.48	-1.28	4.86	0.10	-----	3.9	7	14	9
1911	46.7	-2.0	86	3	3.09	+0.23	6.04	1.33	-----	3.6	9	11	8
1912	49.9	+1.2	84	20	2.66	-0.29	6.66	0.78	-----	1.1	8	13	8
1913	50.2	+1.5	88	16	3.38	+0.42	7.42	1.12	-----	2.7	9	13	5
1914	48.6	-0.1	88	11	2.52	-0.34	5.03	0.37	-----	0.3	8	10	8
1915	57.2	+8.5	95	18	1.41	-1.45	4.62	0.95	-----	7	7	15	10
1916	47.1	-1.6	99	11	2.62	-0.24	5.92	1.13	-----	1.1	10	10	9

T indicates an amount too small to measure, or less than .065 inch rainfall, and less than .05 inch snowfall.

## MAY.

Over most of the state the month was a rather typical May. The temperature averaged within half a degree of the normal, the precipitation exceeded but slightly the average of past Mays, while both the amount of sunshine and the wind movement corresponded closely to the usual values. The most striking feature of the month was the abnormally heavy precipitation in the extreme southern part of the state. Over a considerable area the amounts were in excess of 7 inches, and in parts of Des Moines, Lee and Van Buren counties more than 9 inches occurred.

No uncommon features were associated with the temperature conditions of the month. In almost all parts of the state the weather was slightly cooler than usual, but the average daily deficiency of temperature amounted to only a fraction of a degree. Moreover, the monthly extremes of temperature, both high and low, were well within the limits established in past years. Most of the monthly minimum temperatures at the individual stations occurred either on the 2d or 18th, the readings ranging from 21° to 38°. The warmest weather was experienced as a rule on the 6th, 7th and 25th, when the maximum temperatures ranged from 83° to 94°. Frost of somewhat damaging character formed on the

18th, injury having been greatest to tender vegetation and strawberries; but in some districts tree fruits were reported to have been hurt.

The heavy showers in the southern counties greatly interfered with the planting and cultivation of corn. At the close of the month a considerable acreage remained unplanted, and much of the corn that was up could not be cultivated. Fields, especially those on low ground, were becoming weedy. On the other hand, the ample rainfall was favorable for meadows and pastures.

The month was marked by a number of severe storms. That of the 7th was characterized by wind and dust. At Dubuque a huge smoke stack was blown down. On the afternoon of the 21st what probably were small tornadoes swept over parts of Polk, Jasper and Marion counties. A number of buildings were wrecked, but no persons were killed. The damage was greatest at Plevantville. On the night of the 26th-27th a violent thunderstorm passed over Clinton, Iowa. Several houses were struck by lightning, and the wind did much damage to trees. Large hail, some of it as large as goose-eggs, was an accompaniment of this storm, and gardens suffered.

**Pressure.**—The mean pressure (reduced to sea level) for the state was 29.85 inches. The highest recorded was 30.30 inches, at Charles City and Dubuque, on the 12th, and the lowest was 29.22, at Sioux City on the 10th. The monthly range was 1.08 inches.

**Temperature.**—The mean temperature for the state, as shown by the records of 165 stations, was 59.9°, or 0.6° lower than the normal. By divisions, three tiers of counties to the division, the means were as follows: Northern, 58.3°, or 0.7° lower than the normal; Central, 60.2°, or 0.5° lower than the normal; Southern, 61.2°, or 0.5° lower than the normal. The highest monthly mean was 62.8°, at Ottumwa, and the lowest was 55.6°, at Estherville. The highest temperature reported was 94°, at Clarinda, on the 6th, and at Logan, on the 25th, and the lowest was 27°, at Estherville, on the 2d. The temperature range for the state was 67°.

**Humidity.**—The average relative humidity for the state at 7 a. m. was 76 per cent, and at 7 p. m. it was 56 per cent. The mean for the month, 66 per cent, is practically the normal. The highest monthly mean was 70 per cent, at Charles City and Keokuk, and the lowest was 65 per cent, at Des Moines, Dubuque, and Sioux City.

**Precipitation.**—The average precipitation for the state, as shown by the records of 111 stations was 4.83 inches, or 0.36 of an inch more than the normal. By divisions the averages were as follows: Northern, 4.64 inches, or 0.16 of an inch more than the normal; Central, 4.19 inches, or 0.40 of an inch less than the normal; Southern, 5.97 inches, or 1.33 inches more than the normal. The greatest amount, 10.44 inches, occurred at Burlington, and the least, 2.04 inches, at Denison. The greatest amount in 24 consecutive hours, 3.09 inches, occurred at Corning, on the 13th.

**Snowfall.**—The only measurable amount of snowfall was 0.1 of an inch, at Inwood, on the 15th, but a trace occurred at eight stations in extreme northern Iowa, on the 1st, 15th or 16th.

**Wind.**—The prevailing direction of the wind was from the southwest. The highest velocity reported from a regular Weather Bureau station was 49 miles an hour from the northwest, at Sioux City, on the 10th.

**Sunshine and Cloudiness.**—The average per cent of the possible amount of sunshine was 62, or about 2 per cent more than normal. The per cent of the possible amount at the regular Weather Bureau stations was as follows: Charles City, 56; Davenport, 66; Des Moines, 67; Dubuque, 55; Keokuk, 63; Sioux City, 65; Omaha, Nebr., 62.

**Miscellaneous Phenomena.**—Dates of: Hall, 3d, 6th, 7th, 14th, 15th, 16th, 17th, 20th, 21st, 23d, 24th, 25th, 26th, 27th; Sleet, 15th, 16th; Thunder, all except the 4th and 30th.

**Rivers.**—At Clinton, Iowa, the Mississippi reached a stage of 13.0 feet, on May 5th; at Le Claire, Iowa, 12.1 feet, on May 5th; at Davenport, 15.9 feet, on May 5th and 6th, and at Muscatine, Iowa, 17.7 feet, on May 7th and 8th, which were the highest stages since the year 1892. On May 4th, a break in the levee protecting Muxratine Island, occurred about 7 miles below the city of Muscatine. Two other breaks occurred at the same levee before the crest of the flood was reached, and 37,000 acres of valuable land were flooded in Iowa, below Muscatine, causing an estimated loss to prospective crops on that area of about \$10.00 an acre.

In the Dubuque river district the losses during the April-May floods were estimated at \$225,000.

## COMPARATIVE DATA FOR THE STATE—MAY.

YEAR	Temperature			Precipitation			Number of Days						
	Mean	Deapth	Highst	Lowst	Total	Deapth	Greatest	Least	Snow fall	With perceptible fall within 24 hr.	Clear	Partly cloudy	Cloudy
1890	57.7	- 2.8	90	26	3.56	-1.01	6.44	1.61	-----	9	10	12	8
1891	58.3	- 2.2	94	21	3.18	-1.39	7.19	1.46	-----	8	14	9	8
1892	54.0	- 0.5	89	29	8.77	+4.20	12.64	4.87	-----	16	15	9	17
1893	56.6	- 3.9	96	24	2.45	-1.12	5.82	1.95	-----	9	12	9	9
1894	61.1	0.6	96	24	1.87	-2.70	4.77	0.23	-----	6	17	10	4
1895	61.7	+ 1.2	104	24	3.19	-1.38	5.79	0.84	-----	9	11	12	8
1896	65.5	+ 5.0	100	34	6.69	+2.12	11.79	3.40	-----	12	11	12	8
1897	58.5	- 2.9	96	20	1.92	-2.65	2.59	0.21	-----	5	15	10	12
1898	59.9	- 0.9	92	26	4.67	+0.10	7.82	2.32	-----	12	9	10	12
1899	60.2	- 0.3	90	27	6.23	+1.66	11.47	3.09	-----	13	9	12	10
1900	63.2	+ 2.7	98	22	3.31	-1.26	6.98	0.96	-----	8	14	10	7
1901	60.7	+ 0.2	95	28	2.25	-2.22	4.37	0.72	-----	7	16	9	6
1902	63.8	+ 2.3	97	25	5.59	+0.82	10.94	0.87	-----	13	10	12	9
1903	61.6	+ 1.1	91	24	8.55	+3.98	15.45	2.88	-----	16	9	12	10
1904	50.6	- 0.9	93	27	3.78	-0.79	8.15	1.50	-----	8	15	10	8
1905	58.2	- 2.2	88	28	5.53	+1.38	10.83	2.57	-----	14	12	11	8
1906	60.8	+ 0.3	95	24	3.54	-1.03	10.72	0.89	-----	11	13	10	8
1907	53.3	- 7.0	96	14	3.48	-1.09	7.68	0.71	-----	1,9	10	11	10
1908	59.6	- 1.1	91	13	8.54	+2.77	14.33	1.33	-----	9	12	11	11
1909	57.9	- 2.6	97	18	4.34	-0.23	7.85	1.96	-----	0,1	9	12	7
1910	55.4	- 5.1	89	18	2.41	-1.16	6.91	1.29	-----	T	10	15	9
1911	64.9	+ 3.4	98	23	2.76	-0.81	8.73	0.42	-----	9	16	9	9
1912	62.7	+ 2.2	97	20	3.35	-1.24	6.41	0.72	-----	0	10	14	11
1913	59.4	- 1.1	102	20	6.24	+1.67	10.25	3.14	-----	0	13	11	11
1914	62.2	+ 1.7	98	25	3.31	-1.26	9.90	0.30	-----	T	14	9	13
1915	56.1	- 4.4	99	25	7.34	+2.77	13.21	3.82	-----	T	10	11	11
1916	59.9	- 0.6	94	27	4.02	+0.35	10.42	2.14	-----	T	12	13	10

T Indicates an amount too small to measure, or less than .005 inch of precipitation, and less than .05 inch of snowfall.

## JUNE.

Persistent coolness and a rain and electrical storm of great severity in the northeastern counties on the night of the 1st, constituted the leading climatological features of June, 1916, in Iowa. There were but few days during the month that were not cooler than usual, and the mean temperature was lower than in any other June since state-wide observations were begun in 1890. No marked warmth occurred until the last two days of the month when in some sections were experienced the highest temperatures since the summer of 1914. The storm already referred to was one of the most destructive of record in northeastern Iowa. Sixteen persons were killed when a passenger train ran into a washout, and the monetary losses totaled at least \$500,000. This storm will be described in greater detail in the July report.

While the month was moderately dry over most of the state, the rains came at such timely intervals that no serious effects of the deficiency of moisture were felt in any section. However, by the close of the month rain was needed in many localities.

The weather of the month was favorable for most crops except corn; growth of the latter was retarded by the cool weather, but the crop made a remarkable response to the warm, humid conditions of the closing days.

**Pressure.**—The pressure (reduced to sea level) for the state was 29.87 inches. The highest recorded was 30.25 inches, at Dubuque, on the 22d, and the lowest was 29.39, at the same station, on the 8th. The monthly range was 0.86 of an inch.

**Temperature.**—The mean temperature for the state, as shown by the records of 110 stations, was 64.5°, or 4.6° lower than the normal. By divisions, three tiers of counties to the division, the means were as follows: Northern, 63.2°, or 4.4° lower than normal; Central, 64.7°, or 4.6° lower than normal; Southern, 65.7°, or 4.6° lower than the normal. The highest monthly mean was 68.0°, at Thurman, in the extreme southwestern part of the state, and the lowest was 61.6°, at Postville, in the extreme northeast. The highest temperature reported was 96°, at Burlington, Cedar Rapids, Mount Pleasant and Whitten, on the 30th, and the lowest was 38°, at Wauhatch, on the 18th and 20th, and at Matlock, on the 19th. The temperature range for the state was 58°.

**Humidity.**—The average relative humidity for the state at 7 a. m. was 81 per cent, and 7 p. m. it was 62 per cent. The mean for the month was 71 per cent, or 2 per cent higher than the normal. The highest monthly mean was 75 per cent, at Charles City and Keokuk, and the lowest was 67 per cent, at Des Moines.

**Precipitation.**—The average precipitation for the state, as shown by the records of 115 stations, was 3.71 inches, or 0.67 of an inch less than the normal. By divisions the averages were as follows: Northern, 4.21 inches, or 0.22 of an inch less than the normal; Central, 3.06 inches, or 1.25 inches less than the normal; Southern, 3.85 inches, or 0.54 of an inch less than the normal. The greatest amount, 7.96 inches, occurred

at Postville, and the least, 1.41 inches, at Gilman. The greatest amount in 24 consecutive hours, 4.32 inches, occurred at Postville, on the 1st-5th.

**Wind.**—The prevailing direction of the wind was from the northwest. The highest velocity reported from a regular Weather Bureau station was 60 miles an hour, from the northwest, at Sioux City, on the 22d.

**Sunshine and Cloudiness.**—The average per cent of the possible amount of sunshine was 68, or about 1 per cent more than the normal. The per cent of the possible amount at the regular Weather Bureau stations was as follows: Charles City, 53; Davenport, 70; Des Moines, 74; Dubuque, 70; Keokuk, 70; Sioux City, 65; Omaha, 60.

**Miscellaneous Phenomena.**—Dates of: Hail, 1st, 7th, 13th, 14th, 15th, 16th, 17th, 22d, 29th; Thunderstorms, all except the 5th and 30th. A lunar rainbow was observed at Des Moines on the 15th.

**Rivers.**—The Mississippi River at Dubuque was moderately high during the first half of the month, with a maximum stage of 15.6 feet on the 5th. A rise of 3.2 feet from the 1st to the 5th resulted from the great storm of the 1st. After the 5th there was a steady fall through the month, with a stage of 9.8 feet on the 30th. At Davenport the river rose steadily during the first decade, reaching a stage of 13.0 feet on the 10th, 11th and 12th, after which time it fell steadily until the end of the month. On the 30th the stage at Davenport was 8.6 feet. At Sioux City the Missouri River rose to near flood stage by the close of the month.

COMPARATIVE DATA FOR THE STATE—JUNE.

YEAR	Temperature				Precipitation				Number of Days			
	Mean	Departure	Highest	Lowest	Total	Departure	Greatest	Least	With precipi- tation .01 in.	Clear	Partly cloudy	
1800	72.7	+3.6	106	44	7.76	+3.38	16.53	1.57	11	12	19	4
1801	69.1	0.0	99	37	5.39	+1.01	19.38	1.56	11	8	19	12
1802	69.2	+0.1	102	42	5.19	+0.81	14.39	0.67	10	12	11	7
1803	71.2	+2.1	100	40	3.91	-0.47	7.56	1.28	8	15	11	4
1804	72.2	+4.1	104	34	2.67	-1.71	6.29	0.57	7	10	19	10
1805	69.7	+0.6	102	34	4.32	-0.06	9.25	0.98	10	11	19	5
1806	69.1	0.0	100	40	3.11	-1.27	7.89	0.81	9	12	15	5
1807	69.1	0.0	103	39	3.31	-0.57	9.38	1.05	10	10	12	8
1808	71.4	+2.3	99	42	4.72	+0.34	12.48	1.90	9	13	19	7
1809	70.7	+1.6	100	42	5.04	+0.66	11.99	1.10	10	12	19	3
1800	69.7	+0.6	102	38	3.98	-0.40	12.35	0.67	8	17	10	3
1801	72.3	+3.2	106	39	3.71	-0.67	7.54	1.05	9	15	11	4
1802	68.2	-3.0	97	32	7.19	+2.78	16.04	1.48	14	8	11	11
1803	64.6	-4.5	96	30	2.80	-1.52	6.04	0.75	10	13	19	7
1804	67.1	-2.0	94	35	3.45	-0.95	8.35	0.84	7	12	19	7
1805	67.9	+0.8	100	36	5.53	+1.15	14.89	1.80	10	12	11	7
1806	65.2	-1.3	96	37	2.92	-0.45	8.27	1.48	8	15	19	5
1807	66.5	-2.6	98	35	5.35	+0.97	9.33	2.07	11	14	9	8
1808	67.1	-2.0	94	35	5.00	+1.38	11.88	1.77	13	12	19	7
1809	69.1	0.0	96	40	6.41	+2.03	12.90	2.80	13	12	19	5
1900	69.5	+0.4	100	38	1.99	-2.39	5.51	0.65	7	18	7	5
1901	75.7	+6.6	108	36	1.82	-2.50	6.28	0.95	5	20	8	2
1902	66.2	-2.9	101	34	2.74	-1.64	5.71	0.78	7	19	8	4
1913	71.6	+2.4	102	33	3.31	-1.07	8.95	0.74	7	15	9	3
1914	72.5	+3.1	101	40	5.37	+1.19	13.24	1.17	13	12	12	4
1915	65.1	-4.0	91	31	4.15	-0.22	9.90	1.72	11	12	15	4
1916	64.5	-4.6	93	33	3.71	-0.67	7.06	1.41	10	13	11	6

## JULY.

July, 1916, in Iowa will be long notable in the climatological annals of the state as a period of extreme heat and dryness. With the single exception of the memorable July of 1901 it was the warmest month of record in Iowa, and of all Julys, that of 1894 alone was drier. The month will be noteworthy more for its general warmth as a whole than for any excessively high temperatures that occurred. Although thermometer readings exceeding 100° were common on a number of days, yet the absolute highest temperature reported was but 105°; this is several degrees lower than the figures attained in a number of other years. Since the mean temperature from day to day was almost continuously above the normal it can not be said that the month had any cool periods. As a rule monthly minimum temperatures at the individual stations were as high or higher than any similar record in the past. The hottest part of the month comprised the 7-day period ending on the 50th, which was, with two exceptions, the warmest week of record in Iowa.

The average precipitation for the whole state was considerably less than one-half the normal, and only six stations reported an excess. While the showers came at rather timely intervals, especially during the first two decades of the month, the geographical distribution was decidedly irregular, as may be seen by reference to the precipitation chart at the end of this report. An extreme illustration of this irregularity is afforded by the records of two rain gauges in Des Moines. The gauge at the regular Weather Bureau station caught 1.50 inches, while another not two miles distant showed a fall of 3.03 inches. In some localities moisture was needed early in the month, but actual droughty conditions did not set in until the last decade. At that time all vegetation was in urgent want of rain, and potatoes, garden truck and pastures were suffering severely, while corn was imperiled. Fortunately, showers occurred on the 31st in a number of localities and were highly beneficial, but in other districts either no rain fell or the amounts were inadequate.

Naturally, the extreme heat was trying to both man and beast. Many persons were prostrated—some fatally, and a large number of animals died. In some cases manufacturing establishments either suspended or curtailed operations at the time of the most intense heat. That the drawbacks of the month had in some degree their compensations is indicated from the fact that the weather was exceptionally favorable for harvesting and threshing owing to the large number of clear, sunny days. The amount of sunshine was among the greatest ever recorded in Iowa in any month.

**Pressure.**—The mean pressure (reduced to sea level) for the state was 29.97 inches. The highest recorded was 30.27 inches, at Sioux City, on the 31st, and the lowest was 29.72, at Davenport, on the 2d, and at Sioux City, on the 3d. The monthly range was 0.55 of an inch.

**Temperature.**—The mean temperature for the state, as shown by the records of 105 stations, was 79.7°, or 5.6° higher than the normal. By

divisions, three tiers of counties to the division, the means were as follows: Northern, 78.6°, or 5.9° higher than the normal; Central, 79.9°, or 5.6° higher than the normal; Southern, 80.5°, or 6.4° higher than the normal. The highest monthly mean was 83.5°, at Keokuk, and the lowest was 75.2°, at Postville. The highest temperature reported was 105°, at Ottumwa, on the 26th, and at Olin, on the 28th; the lowest was 48°, at Estherville, on the 20th. The temperature range for the state was 57°.

**Humidity.**—The average relative humidity for the state at 7 a. m. was 74 per cent, and at 7 p. m. it was 53 per cent. The mean for the month was 64 per cent, or 4 per cent lower than the normal. The highest monthly mean was 70 per cent, at Charles City, and the lowest was 60 per cent, at Dubuque.

**Precipitation.**—The average precipitation for the state, as shown by the records of 115 stations, was 1.78 inches, or 2.18 inches less than the normal. By divisions the averages were as follows: Northern, 2.07 inches, or 1.81 inches less than the normal; Central, 1.59 inches, or 2.29 inches less than the normal; Southern, 1.59 inches, or 2.43 inches less than the normal. The greatest amount, 6.87 inches, occurred at Cedar Rapids, and the least, 0.10 of an inch, at Keokuk. The greatest amount in 24 consecutive hours, 4.46 inches, occurred at Cedar Rapids, on the 19th.

**Wind.**—The prevailing direction of the wind was from the south. The highest velocity reported from a regular Weather Bureau station was 37 miles an hour, from the south, at Stoyx City, on the 18th.

**Sunshine and Cloudiness.**—The average percent of the possible amount of sunshine was 85, or 13 per cent more than the normal. The per cent of the possible amount at the regular Weather Bureau stations was as follows: Charles City, 71; Davenport, 85; Des Moines, 91; Dubuque, 87; Keokuk, 80; Sioux City, 84.

**Miscellaneous Phenomena.**—Dates of: Hall: 2d, 12th, 17th, 22d, 23d, 24th; Thunderstorms, 2d, 3d, 4th, 8th, 9th, 11th to 25th, Inc., 29th, 30th, 31st.

**Rivers.**—The Mississippi at Dubuque was almost stationary at slightly more than 9 feet during the first 10 days; then it rose to a maximum of 10.9 feet on the 20th, after which it fell steadily, reaching a minimum of 8.0 feet at the end of the month. The average stage at that point was 9.8 feet, which is high for July. In the Davenport district the river averaged almost 2 feet lower at the end of the month than at the beginning, but good boating stages still prevailed.

## COMPARATIVE DATA FOR THE STATE—JULY.

YEAR	Temperature				Precipitation				Number of Days			
	Mean	Departure	Highest	Lowest	Total	Departure	Greatest	Least	With precipi- tation, in (in.)	Clear	Partly cloudy	Cloudy
1880	75.6	+1.5	110	45	1.98	-1.98	5.00	0.37	3	18	8	5
1881	82.5	-5.6	100	41	4.32	+0.30	8.20	1.67	8	13	13	5
1882	73.0	-1.1	104	38	5.32	+1.33	12.86	1.71	9	10	10	2
1883	75.0	+0.9	102	47	3.33	-0.63	8.84	1.49	7	19	10	2
1884	76.4	+2.3	109	39	0.63	-3.23	3.50	7	8	22	8	1
1885	72.1	-2.0	104	35	3.40	-0.50	10.10	0.45	7	15	12	4
1886	72.6	-0.5	104	42	6.90	+2.94	12.67	1.61	9	14	11	4
1887	75.6	+1.5	100	42	3.30	-0.70	7.60	1.01	6	18	10	3
1888	73.4	-0.7	102	42	2.98	-0.98	12.88	0.50	7	19	9	3
1889	73.1	-1.0	101	38	3.07	-0.89	8.66	0.42	7	16	10	5
1890	73.4	-0.7	102	37	0.15	+2.19	18.45	1.80	9	16	10	5
1891	82.4	+8.2	112	46	2.34	-1.02	5.97	0.27	5	18	10	2
1892	72.1	-1.0	99	41	8.67	+4.71	15.57	4.82	13	14	10	7
1893	72.9	-1.2	100	40	4.83	+0.87	15.72	0.94	9	17	9	5
1894	70.8	-3.5	103	38	4.41	+0.45	11.97	1.38	10	16	9	6
1895	70.6	-3.5	102	30	2.31	-1.05	7.98	0.36	9	14	7	7
1896	70.9	-3.2	102	42	3.04	-0.92	7.05	0.39	8	13	10	3
1897	72.7	-0.4	102	41	7.27	+3.31	13.60	3.97	13	16	11	4
1898	72.9	-1.1	100	42	5.06	+0.80	9.21	0.79	8	16	10	5
1899	72.3	-1.8	102	46	4.77	+0.81	15.30	1.29	10	15	8	8
1900	74.5	+0.4	106	43	1.80	-2.10	5.69	0.13	7	19	8	4
1911	75.5	+1.4	111	28	2.27	-1.09	6.02	0.08	7	18	10	3
1912	74.8	+0.5	103	28	3.71	-0.25	7.50	1.17	10	17	10	4
1913	76.1	+2.0	108	45	1.82	-2.14	6.25	7	5	21	8	3
1914	76.8	+2.5	109	43	3.27	-1.09	6.50	0.44	5	20	8	3
1915	69.5	-4.6	95	40	8.22	+4.58	15.81	3.69	14	19	12	9
1916	79.7	+4.6	105	48	1.78	-2.18	6.87	0.10	5	23	7	1

**Storm of June 1, 1916, in Northeastern Iowa.**—By J. H. Spencer, Meteorologist, U. S. Weather Bureau. The storm in northeastern Iowa on June 1, 1916, was one of the most destructive on record in this part of the state, owing to the resulting local floods. Exceptionally heavy rainfall was recorded and it was the result of severe thunderstorms. These storms occurred between 5:00 p. m. and midnight, and most of the rain fell in less than three hours. At Decorah the amount of rainfall was 3.21 inches and the time of heaviest fall, between 5:30 p. m. and 7:00 p. m. The result of such heavy rainfall in such a short period of time was that in the more hilly sections floods of an exceptionally destructive character occurred. A great volume of water rushed down the steep hillsides into creeks or small rivers, sweeping away bridges, buildings, live stock, etc.

The greatest losses were at Decorah, Fort Atchison, and McGregor, but there was hardly a railroad line in northeastern Iowa that did not experience damage of some sort. More than 25 large railroad bridges and a large number of county bridges and culverts were damaged or destroyed. The water rushed through the principal street of McGregor, flooding stores, and doing great damage.

At Packard a passenger train ran into a washout, and 16 persons were killed and many injured.

Damage was so severe to railroad property that normal traffic on some of the branch lines of northeastern Iowa was not resumed for six weeks or more. It will, in fact, require many months to complete permanent repairs. Losses are estimated to be at least \$500,000, divided as follows: \$250,000 to railroads, roadbed and track, rolling stock and contents, etc.; \$150,000 to the various counties visited by the storm, bridges and culverts, chiefly; \$100,000 to private individuals—stocks of merchandise, live stock, suspension of business, wages of employes, etc.

### AUGUST.

The month was marked by a continuance, but in a modified degree, of the hot, dry weather that featured July. The temperature averaged above the normal until the 22d, except during the 5-day period beginning on the 11th. Most of the last decade was cooler than usual, with light frosts reported from a few northern stations on the 27th and 28th.

The state received about 70 per cent of the normal August precipitation, and much the greater part of this came during the first half of the month. The rains broke the severe drought in most districts and were of inestimable value to all growing crops, but especially to corn. In some sections, however, that crop had already been seriously damaged by the dry weather. After the 15th but little rain fell in any part of the state until the last day of the month, with the result that the ground became too dry for plowing.

A severe wind and electrical storm occurred at Sioux City on the 6th. The total loss in the city was estimated at \$100,000. For one minute the wind blew at the rate of 120 miles an hour, which is the highest velocity on record at that station for a similar length of time.

An auroral display of marked brilliancy occurred on the night of the 26th-27th; a brief description of the phenomenon appears under the heading "Miscellaneous Phenomena."

**Pressure.**—The mean pressure (reduced to sea level) for the state was 29.98 inches. The highest recorded was 30.34 inches, at Charles City, on the 13th, and the lowest was 29.54, at Sioux City, on the 10th. The monthly range was 0.80 of an inch.

**Temperature.**—The mean temperature for the state, as shown by the records of 106 stations, was 74.0°, or 2.2° higher than the normal. By divisions, three tiers of counties to the division, the means were as follows: Northern, 72.3°, or 1.9° higher than the normal; Central, 74.6°, or 2.1° higher than the normal; Southern, 75.5°, or 2.4° higher than the normal. The highest monthly mean (only complete records considered) was 71.5°, at Keokuk, and the lowest was 69.7°, at Sibley. The highest temperature reported was 106°, at Webster City, on the 4th, and the lowest was 55°, at Matlock, on the 27th. The temperature range for the state was 71°.

**Precipitation.**—The average precipitation for the state, as shown by the records of 116 stations, was 2.58 inches, or 1.10 inches less than the normal. By divisions the averages were as follows: Northern, 2.81

inches or 1.47 inches less than the normal; Central, 2.77 inches, or 1.00 inch less than the normal; Southern, 2.96 inches, or 0.82 of an inch less than the normal. The greatest amount, 6.23 inches, occurred at Thurman, and the least, 0.49 of an inch, at Delaware. The greatest amount in 24 consecutive hours, 3.21 inches, occurred at Bloomfield, on the 10th-11th.

**Humidity.**—The average relative humidity for the state at 7 a. m. was 75 per cent, and at 7 p. m. it was 58 per cent. The mean for the month was 69 per cent, or 2 per cent lower than the normal. The highest monthly mean was 73 per cent, at Charles City and Keokuk, and the lowest was 65 per cent, at Davenport and Des Moines.

**Wind.**—The prevailing direction of the wind was from the southwest. The highest velocity reported from a regular Weather Bureau station was 70 miles an hour, from the southwest, at Sioux City, on the 6th.

**Sunshine and Cloudiness.**—The average per cent of the possible amount of sunshine was 72, or 1 per cent more than the normal. The per cent of the possible amount at the regular Weather Bureau stations was as follows: Charles City, 71; Davenport, 73; Des Moines, 78; Dubuque, 76; Keokuk, 73; Sioux City, 69.

**Rivers.**—The Mississippi River fell steadily throughout the month. At Dubuque the fall was from a stage of 7.8 feet on the 1st to 4.3 feet on the 30th. At Davenport the river fell from 5.0 feet on the 1st to 3.2 feet on the 31st. The smaller streams in the vicinity of the last named station dried up.

**Miscellaneous Phenomena.**—A brilliant display of the aurora borealis occurred on the night of the 26th-27th. The phenomenon was visible in all parts of the state. The illumination was first observed about dusk and it continued past 12 o'clock midnight of the 26th. The most marked features of the display were the flashing of the streamers and the appearance of a whitish band of light. At times the streamers extended upward past the zenith and many degrees to the southward. In country districts away from the lights of cities and towns, the auroral light was reported to have covered a large part of the sky. The display was most pronounced between 8:30 p. m. and 9 p. m. The band of whitish light had a width of from 2 to 3 degrees and when first seen, about 9 p. m., extended almost across the sky from horizon to horizon, one end being a few degrees south of east and the other at the opposite side of the sky. The crown or top of the band passed almost through the zenith. The whole band was drifting southward and slowly fading. By 9:15 p. m. it had vanished, the crown having moved southward about 20°.

Dates of: Hail: 6th, 26th; Thunderstorms: All but the 16th, 18th, 23rd, 27th, 29th; Fog: 8th, 9th, 14th, 15th, 16th, 24th; Solar halos: 20th, 29th, 30th; Lunar halos: 18th.

COMPARATIVE DATA FOR THE STATE—AUGUST.

YEAR	Temperature				Precipitation				Number of Days			
	Mean	Departure	Highest	Lowest	Total	Departure	Greatest	Least	With precip- itation 48 in.	Clear	Partly cloudy	Cloudy
1890	68.4	-3.4	102	36	3.41	-0.27	6.44	1.02	8	15	30	4
1891	69.1	-2.7	106	34	4.24	-0.56	13.05	1.23	8	13	12	4
1892	71.4	-0.4	102	40	2.74	-1.34	4.09	0.65	5	28	9	4
1893	69.4	-2.1	101	30	2.37	-1.26	6.22	0.40	5	19	9	4
1894	74.6	+2.8	108	38	1.58	-2.10	4.53	T	4	21	8	4
1895	71.9	+1.1	103	37	4.43	+0.75	10.63	0.67	7	17	9	3
1896	71.7	-0.1	104	34	3.22	-0.16	12.23	0.86	8	15	11	3
1897	68.9	-2.9	104	35	1.86	-1.82	4.98	0.47	6	15	11	3
1898	71.2	-0.6	103	40	3.44	-0.24	10.55	0.56	6	17	9	3
1899	74.4	+3.6	106	41	3.65	0.00	10.45	1.12	7	17	10	4
1900	77.4	+5.6	103	44	4.65	+0.97	10.43	1.28	6	18	16	2
1901	69.1	-2.9	105	40	1.29	-3.29	4.46	T	6	20	9	2
1902	69.1	-2.7	98	27	6.58	+2.90	15.47	1.57	11	31	11	9
1903	69.1	-2.7	101	41	6.94	+3.16	17.74	2.55	11	27	10	2
1904	69.1	-2.7	97	35	3.43	-0.25	6.75	0.66	7	37	8	5
1905	74.3	+2.5	104	44	4.55	+0.57	8.47	1.04	9	16	9	6
1906	74.1	+2.3	101	33	3.95	+0.27	10.51	0.92	9	17	9	4
1907	71.1	-0.7	99	37	4.33	+0.65	9.67	1.05	9	17	9	4
1908	70.0	-1.8	101	38	4.77	+1.09	19.55	1.35	9	17	9	4
1909	76.1	+4.3	103	33	1.81	-1.87	8.21	T	5	21	4	2
1910	71.9	+0.1	104	36	3.88	+0.29	11.22	0.57	8	15	10	4
1911	71.7	-0.1	107	34	3.22	-0.36	9.47	0.44	9	16	10	5
1912	71.0	-0.8	101	40	3.78	+0.10	7.99	0.89	10	15	10	6
1913	76.6	+4.8	108	40	2.68	-1.00	7.13	0.68	6	17	10	4
1914	73.7	+1.9	103	40	2.19	-1.49	4.99	0.82	7	17	10	4
1915	65.9	-5.9	91	30	2.81	-0.87	9.14	0.72	8	16	8	4
1916	74.0	+2.2	105	35	2.58	-1.10	6.23	0.49	7	18	9	4

## SEPTEMBER.

The average conditions that prevailed during the month did not vary much from the normals, yet there were periods when both the temperature and precipitation departures were excessive. This was especially true in regard to the temperature, which was above the normal until the 10th, with daily readings from 10° to 15° above the seasonal average between the 4th and 6th. From the 11th to the 23rd, inclusive, there was a decided deficiency of temperature, the daily departures ranging from 1° to 17°. Another warm spell prevailed from the 24th to the 27th, which was followed by the coolest weather of the month on the 29th. Light to killing frost occurred on the 15th and 18th and killing frost and freezing temperatures were almost general on the 29th. The rainfall was fairly well distributed throughout the month and over the state, except over the south-central district, where the drought that prevailed in that section since early in July continued until the 26th and 27th. The showers on those dates were general and in many localities heavy, and those on the 26th were attended by wind squalls in various sections and by a typical tornado in Page, Taylor and Ringgold counties. The storm apparently developed near Blanchard, in Colfax Township, Page County, and moved northeastward to near Gravit, in Washington Township, Taylor County, being very destructive in East

River Township, Page County, where several farm houses and barns were completely demolished, but no lives were lost. The damage done to farm buildings in Page County amounted to about \$15,000. A storm of great violence did considerable damage in and near Diagonal during the evening of the 26th. This was probably the same storm that passed through Page and part of Taylor counties, or, at least, was caused by the same disturbance, as it was on the same line and moved in the same direction and occurred later in the evening. Very destructive hail accompanied the storm. At Clarinda 1,898 panes of glass were broken in the greenhouse of J. V. Pfander.

However, the month, as a whole, was pleasant and favorable for crops and outdoor occupations. Much plowing was done except in the south-central districts, where the drought prevailed. The bulk of the corn crop was mature at the time of the killing frosts and the only injury done was to some of the late planted corn and mostly on low ground.

*Pressure.*—The mean pressure (reduced to sea level) for the state was 30.0 inches. The highest recorded was 30.40 inches, at Sioux City, on the 28th, and the lowest was 29.59 inches at Des Moines, on the 26th. The monthly range was 1.01 inches.

*Temperature.*—The mean temperature for the state, as shown by the records of 106 stations, was 62.5°, or 1.1° below the normal. By divisions, three tiers of counties to the division, the means were as follows: Northern, 60.7°, or 1.3° below the normal; Central, 62.4°, or 1.0° below the normal; Southern, 64.2°, or 0.9° below the normal. The highest monthly mean was 63.3° at Ottumwa, and the lowest was 58.6°, at Mason City. The highest temperature reported was 98°, at Clarinda, on the 4th and 5th, and Corydon, on the 5th; the lowest was 21° at Sibley and Washta on the 29th. The range for the state was 77°.

*Humidity.*—The average relative humidity for the state at 7 a. m. was 82 per cent, and at 7 p. m. 62 per cent. The mean for the month was 72 per cent, or 2 per cent lower than the normal. The highest monthly mean was 81 per cent, at Charles City, and the lowest was 66 per cent at Des Moines.

*Precipitation.*—The average precipitation for the state, as shown by the records of 113 stations, was 3.89 inches, or 0.36 in more than the normal. By divisions, the averages were as follows: Northern, 4.18 inches, or 0.54 inch more than the normal; Central, 3.82 inches, or 0.37 inch more than the normal; Southern, 3.66 inches, or 0.18 inch more than the normal. The greatest amount, 9.71 inches, occurred at Clarinda, and the least, 1.45 inches, at Monroe. The greatest amount in 24 consecutive hours, 3.80 inches, occurred at Fairfield on the 6th and at Clarinda on the 27th.

*Wind.*—The prevailing direction of the wind was from the southwest. The highest velocity reported from a regular Weather Bureau station was 48 miles an hour from the northwest, at Charles City, on the 6th.

**Sunshine and Cloudiness.**—The average per cent of the possible amount of sunshine was 65 per cent. The per cent of the possible amount at the regular Weather Bureau stations was as follows: Charles City, 46; Davenport, 66; Des Moines, 71; Dubuque, 65; Keokuk, 70; Sioux City, 54; Omaha, Nebr., 69.

**Miscellaneous Phenomena.**—Dates of: 15, 16, 17, 18, 23 and 29; general killing frost, 29; thunderstorms, 4, 5, 6, 7, 10, 11, 12, 24, 25, 26, 27; hail, 4, 6, 8, 25, 26, 27; aurora borealis, 13, 26 and 30.

**Rivers.**—The stage of the Mississippi River, at Dubuque, was near 5 feet throughout the month, and at Davenport it ranged from 3.1 feet on the 1st, 2nd and 3rd to 4.4 feet on the 28th, 29th and 30th.

COMPARATIVE DATA FOR THE STATE—SEPTEMBER.

YEAR	Temperature				Precipitation			Number of Days				
	Mean	Departure	Highest	Lowest	Total	Departure	Greatest	Least	With pre. of in. or more	Clear	Partly cloudy	Cloudy
1860	59.3	-4.1	96	23	2.97	-0.39	4.85	1.96	7	13	10	7
1861	67.3	+1.3	104	28	1.33	-2.16	3.69	0.13	4	20	7	2
1862	64.1	+1.3	99	29	1.53	-1.33	4.15	0.16	4	16	8	6
1863	64.7	+1.3	102	18	2.34	-1.02	5.49	0.74	4	20	6	4
1864	65.1	+1.7	100	26	3.57	+0.21	7.43	0.67	8	15	10	9
1865	66.8	+2.4	102	22	3.03	-0.33	7.43	0.85	3	18	8	6
1866	58.5	-4.9	95	32	4.89	+0.73	9.96	1.32	10	11	9	10
1867	70.9	+7.5	106	35	2.04	-1.32	5.88	0.00	4	23	5	2
1868	65.3	+1.9	99	29	2.69	-0.67	8.45	0.41	7	16	9	5
1869	62.5	-0.9	104	15	0.93	-2.43	4.32	0.1	4	16	9	5
1860	64.0	+1.0	96	4.98	+1.22	3.23	2.43	4	15	8	7	8
1861	63.3	-0.1	102	26	4.77	+1.41	13.62	1.71	9	12	9	8
1862	59.1	-4.3	88	22	4.35	+0.99	10.41	1.65	9	15	6	9
1863	60.8	-2.6	94	28	2.81	+0.45	8.79	1.42	10	14	6	10
1864	64.0	+0.6	96	30	2.78	-0.58	8.33	0.60	7	15	8	9
1865	65.8	+2.4	98	35	3.51	+0.45	13.18	0.50	8	14	8	8
1866	67.2	+3.8	100	27	4.16	+0.80	11.10	0.64	8	16	8	6
1867	62.8	-0.6	98	25	2.75	-1.61	6.06	1.38	8	15	9	8
1868	67.9	+4.5	98	20	1.30	-2.16	2.65	0.23	21	11	8	7
1869	62.4	-1.9	94	30	3.58	+0.22	7.34	1.39	9	14	8	8
1870	62.2	-0.2	99	30	3.59	+0.23	7.43	1.18	9	14	7	9
1871	65.8	+2.4	103	32	5.12	+1.76	13.73	1.19	10	11	9	10
1872	69.1	-1.3	104	14	3.98	+0.62	10.12	0.28	11	12	8	7
1873	64.5	+1.1	107	19	3.31	-0.05	7.44	0.45	9	15	8	7
1874	64.5	+1.1	99	30	7.88	+4.52	16.24	2.48	10	16	7	7
1875	63.7	+0.3	91	30	6.03	+3.67	12.45	2.88	11	11	8	11
1876	62.5	-1.1	98	21	3.89	+0.36	9.71	1.45	7	17	8	6

## OCTOBER.

As a whole, October was a typical autumn month for this mid-central region; the average temperature, rainfall and sunshine approximated the normals very closely, but there was sufficient variation in the daily amounts to give a stimulating effect to man and beast. The month opened warm and dry, but showers were more or less frequent during the second and third decades, especially over the central and eastern dis-

tricts, and the lowest temperatures were recorded generally on the 20th or 21st. The only feature out of the ordinary being a severe snowstorm on the 19th and 20th, when snow fell in all parts of the State except the extreme eastern counties. Several stations in the northwestern district reported more than 5.0 inches of snowfall, and in numerous localities the drifts were several feet deep. This storm, together with the frequent rains between the 20th and 28th, interfered with corn husking, which had begun earlier than usual. Husking was, however, resumed during the last few days of the month and 20 to 30 per cent of the crop had been gathered by the close of the month. Stock was in pasture, and in many localities flowers were in bloom at the end of the month.

**Pressure.**—The mean pressure (reduced to sea level) for the state was 30.05 inches. The highest recorded was 30.63 inches, at Sioux City, on the 19th, and the lowest was 29.37 inches, at Davenport on the 20th. The monthly range was 1.26 inches.

**Temperature.**—The mean temperature for the State, as shown by the records of 104 stations, was 50.9°, or 0.1° above the normal. By divisions, three tiers of counties to the division, the means were as follows: Northern, 48.5°, or 0.5° below the normal; Central, 51.0°, or 0.1° above the normal; Southern, 53.1°, or 0.5° above the normal. The highest monthly mean was 55.3°, at Ottumwa, and the lowest, 45.9°, at Northwood. The highest temperature reported was 92°, at Toledo on the 7th; the lowest was 6°, at Sibley on the 21st. The range for the State was 86°.

**Precipitation.**—The average precipitation for the State, as shown by the record of 109 stations, was 2.60 inches, or 0.46 inch less than the normal. By divisions the averages were as follows: Northern, 1.45 inches, or 0.89 inch less than the normal; Central, 2.37 inches, or 0.12 inch less than the normal; Southern, 2.18 inches, or 0.36 inch less than the normal. The greatest amount, 4.33 inches, occurred at Clinton, and the least, 0.20 inch, at Lake Park. The greatest amount in 24 consecutive hours, 2.98 inches, occurred at Oskaloosa on the 23d-24th.

**Humidity.**—The average relative humidity for the State at 7 a. m. was 79 per cent, and at 7 p. m., 62 per cent. The mean for the month was 70 per cent, or 2 per cent below the normal. The highest monthly mean was 78 per cent, at Charles City, and the lowest, 56 per cent, at Des Moines.

**Snow.**—One of the heaviest October snow storms on record occurred on the 19th-20th. The fall was general except over the extreme eastern counties north of Louisa. More than 4 inches was reported from the extreme northwestern part of the State, as well as from a limited district in Des Moines and Lee counties. The average fall for the whole State was 2.0 inches. The greatest monthly amount was 9.6 inches, at Inwood.

**Wind.**—The prevailing direction of the wind was from the south. The highest velocity reported from a regular Weather Bureau station was 40 miles an hour from the southeast, at Sioux City, on the 1st.



*Sunshine and Cloudiness*—The average per cent of the possible amount of sunshine was 59, or 2 per cent below the normal. The per cent of the possible amount at the regular Weather Bureau stations was as follows: Charles City, 51; Davenport, 69; Des Moines, 61; Dubuque, 58; Keokuk, 58; Sioux City, 55; Omaha, Neb., 64.

*Miscellaneous Phenomena*—Dates of: *Aurors*; 4th, 6th; *Dense Fog*, 11th, 13th, 16th, 30th; *Sleet*, 19th, 20th, 23rd, 24th; *Thunderstorms*, 2d 4th, 5th, 12th, 13th, 23d, 26th, 27th, 28th, 29th, 30th.

*Rivers*—Rivers remained nearly stationary during the month.

COMPARATIVE DATA FOR THE STATE—OCTOBER.

YEAR	Temperature				Total	Precipitation				Number of Days			
	Mean	Departure	Highest	Lowest		Departure	Greatest	Least	Snow fall	With ice, of in. or more	Clear	Fairly cloudy	Cloudy
1861	49.2	-1.6	86	16	3.48	+1.02	6.82	1.59	-----	7	11	11	9
1860	50.0	-0.8	92	19	2.77	+0.31	6.53	0.85	-----	6	18	7	6
1862	54.0	+3.7	96	14	1.55	-0.91	2.58	0.09	0.9	4	21	6	4
1863	52.4	+1.6	94	10	1.28	-1.18	4.56	0.02	0.0	4	16	9	6
1864	51.7	+0.9	90	20	2.47	+0.21	5.25	0.03	0.2	8	14	14	9
1865	46.0	-4.8	88	4	0.47	-1.99	1.38	0.00	T.	5	19	8	4
1866	47.9	-2.9	88	12	3.13	+0.67	5.06	1.51	T.	5	18	6	7
1867	56.8	+6.9	97	12	1.14	-1.32	3.50	0.03	0.0	4	17	8	4
1868	47.5	-3.3	88	17	3.56	+1.10	7.15	1.27	3.4	5	7	9	15
1869	56.7	+5.9	95	17	1.72	-0.73	4.64	1.15	0.9	5	17	8	6
1900	59.3	+8.5	90	21	3.91	+1.45	8.00	1.20	0.9	7	16	7	8
1901	54.2	+3.4	88	20	1.98	-0.48	4.23	0.45	T.	6	17	7	7
1902	53.5	+2.7	83	20	2.54	+0.98	6.66	0.28	T.	5	16	8	7
1903	52.7	+1.4	90	16	1.95	-0.51	4.90	0.32	0.0	5	19	0	6
1904	53.1	+2.3	96	16	1.67	-0.79	4.43	0.14	T.	6	15	8	6
1905	49.2	-1.6	95	16	3.40	+0.94	5.56	1.20	1.6	8	16	5	9
1906	50.5	-0.5	87	7	1.56	-0.50	4.25	0.50	0.1	6	14	7	10
1907	50.5	-0.5	87	10	1.50	-0.56	3.71	0.30	0.0	5	20	5	9
1908	50.4	-0.4	88	10	1.50	-0.56	3.71	0.30	0.0	5	20	5	9
1909	49.7	-1.1	97	10	2.22	-0.24	4.70	0.48	T.	6	16	6	9
1910	55.2	+4.4	92	10	0.77	-1.49	1.75	0.	0.1	4	21	6	7
1911	48.7	-1.1	87	14	2.34	+0.88	7.03	0.73	0.6	10	12	8	11
1912	52.2	+1.4	92	16	3.98	+0.52	5.77	1.63	T.	6	21	3	7
1913	49.2	-1.6	89	-2	3.03	+0.57	7.29	0.35	1.2	9	15	6	8
1914	55.9	+5.1	88	14	3.23	+0.77	6.64	0.74	T.	9	16	10	6
1915	54.4	+3.6	86	19	1.31	-1.15	3.25	T.	0.	5	19	6	6
1916	50.9	+0.1	92	6	2.00	-0.46	4.33	0.20	2.0	8	16	7	6

T indicates an amount too small to measure.

## NOVEMBER.

Like the preceding month, November, as a whole, was a very pleasant autumn month, yet at times the conditions were unusual. The most marked feature being the cold spell from the 13th to 15th, inclusive, when the lowest temperature of record, for the first half of November, occurred at many stations. The heavy rains of the 7th-8th was followed by snow on the 11th-12th, but the remainder of the month was mostly bright and clear, making favorable conditions for all kinds of out-door occupations. Practically all of the corn was harvested and considerable plowing was

done. Wild flowers, especially dandelions, were in bloom at the close of the month and winter wheat was in a thriving condition. All of the larger rivers remained open during the entire month, but heavy floating ice was reported in northern sections about the middle of the month and the smaller, shallow lakes were frozen over.

*Pressure*—The mean pressure (reduced to sea level) for the State was 30.09 inches. The highest recorded was 30.54 inches at Sioux City on the 13th, and the lowest was 29.35 inches, at Davenport, on the 23rd. The monthly range was 1.29 inches.

*Temperature*—The mean temperature for the state, as shown by the records of 108 stations, was 37.3°, or 3.3° above the normal. By divisions, three tiers of counties to the division, the means were as follows: Northern, 34.2°, or 1.4° above normal; Central, 37.5°, or 2.3° above the normal; Southern, 40.3°, or 3.0° above the normal. The highest monthly mean was 44.0° at Keokuk and the lowest was 31.3° at Decorah. The highest temperature reported was 80°, at Sigourney on the 7th; the lowest was 8° below zero, at Alton and Sibley on the 14th. The range for the state was 88°.

*Precipitation*—The average precipitation for the state, as shown by the records of 114 stations, was 1.51 inches, or 0.10 inch above the normal. By divisions the averages were as follows: Northern, 1.42 inches, or 0.09 inch above the normal; Central, 1.47 inches, or 0.11 inch less than the normal; Southern, 1.33 inches or 0.32 inch more than the normal. The greatest amount, 3.55 inches, occurred at Onawa, and the least, 0.05 inch, at Matlock. The greatest amount in 24 consecutive hours, 3.25 inches, occurred at Bedford on the 8th.

*Humidity*—The average relative humidity for the state at 7 a. m. was 79 per cent, and at 7 p. m. 70 per cent. The mean for the month was 74 per cent, or 3 per cent below the normal. The highest monthly mean was 82 per cent, at Charles City, and the lowest, 68 per cent, at Des Moines.

*Snow*—The average fall for the whole state was 3.6 inches. The greatest amount was 12 inches, at Northwood.

*Wind*—The prevailing direction of the wind was from the northwest. The highest velocity reported from a regular Weather Bureau station was 48 miles an hour from the south, at Sioux City on the 6th.

*Sunshine and Cloudiness*—The average per cent of the possible amount of sunshine was 56, or 4 per cent above the normal. The per cent of the possible amount at the regular Weather Bureau stations was as follows: Charles City, 67; Davenport, 61; Des Moines, 61; Dubuque, 50; Keokuk, 67; Sioux City, 67.

*Miscellaneous Phenomena*—Dates of: *Fog*: 20, 21, 22, 23, 28, 29; *Sleet*: 11, 12; *Thunderstorms*: 7, 8.

*Rivers*—Rivers remained nearly stationary and at a low stage during the month.

## COMPARATIVE DATA FOR THE STATE—NOVEMBER.

YEAR	Temperature				Total	Precipitation			Snow fall	Number of Days			
	Mean	Departure	Highest	Lowest		Departure	Greatest	Least		With pre. .01 in. or more	Clear	Partly cloudy	Cloudy
1890	38.6	+3.6	78	-2	1.46	-0.05	3.55	0.71	-----	3	15	8	7
1891	30.5	-4.5	84	-24	1.70	+0.19	3.64	0.05	-----	7	10	8	13
1892	33.3	-1.7	70	-3	1.10	-0.41	2.15	0.55	1.2	4	11	8	11
1893	34.0	-1.0	86	-13	1.17	-0.34	2.56	0.05	4.6	4	16	8	6
1894	32.7	-2.3	72	-5	0.92	-0.59	2.42	T	0.4	4	9	11	10
1895	34.3	-0.7	86	-12	1.51	-0.90	3.01	0.45	4.9	6	9	8	13
1896	29.6	-5.4	82	-15	1.83	+0.32	4.31	0.35	7.9	6	9	8	13
1897	34.3	-0.7	81	-19	0.68	-0.53	2.53	T	1.2	5	12	8	10
1898	35.3	-2.8	78	-17	1.50	-0.01	3.01	0.33	8.7	6	14	8	8
1899	43.9	+3.9	80	8	1.29	-0.31	2.97	0.13	0.5	5	12	8	10
1900	33.5	-1.5	79	-6	1.66	-0.45	3.35	T	2.7	6	12	7	11
1901	35.8	+0.8	77	-2	0.86	-0.65	2.30	0.39	2.6	3	18	6	4
1902	41.2	+6.2	79	4	2.13	+0.82	4.19	0.15	1.8	7	9	7	14
1903	34.2	-0.8	76	-5	0.52	-0.99	1.74	T	1.1	3	13	5	9
1904	41.0	+6.0	80	4	0.15	-1.36	0.90	0.55	1	1	20	6	4
1905	38.4	+3.4	70	-12	2.84	+1.23	5.30	0.59	0.6	5	16	7	7
1906	36.1	+0.4	78	-3	2.03	+0.52	3.86	0.35	4.4	8	9	7	14
1907	36.7	+1.7	68	-4	1.03	-0.48	2.27	0.05	0.9	4	17	6	7
1908	39.3	+4.3	80	5	1.76	+0.05	3.31	0.21	1.4	5	14	7	9
1909	42.4	+7.4	84	-3	3.29	+3.88	11.45	2.07	6.8	10	19	7	13
1910	35.4	-1.6	76	-5	0.34	-1.17	1.03	T	0.7	3	15	9	8
1911	29.9	-3.1	79	-8	1.42	-0.69	4.99	0.11	1.6	6	11	5	11
1912	40.1	+5.1	77	6	0.96	-0.53	3.38	0.06	T	2	18	8	4
1913	44.1	+9.1	78	10	1.18	-0.33	3.49	0.39	0.4	8	11	7	12
1914	41.9	+6.9	80	-4	0.32	-1.39	0.65	0.94	T	3	19	6	1
1915	40.2	+5.2	83	-8	1.94	+0.43	4.55	0.30	1.2	6	11	10	9
1916	37.3	+3.3	80	-4	0.61	+0.10	3.55	0.05	3.6	5	16	9	8

T Indicates an amount too small to measure, or less than .005 inch precipitation and less than .05 inch snowfall.

## DECEMBER.

No exceptional features were recorded during the month, except a thunderstorm which occurred over the western three-fourths of the state on the night of the 25th-26th. The second and third decades, however, were much colder than usual and the first week was exceptionally warm; the daily means ranging from 10° to 25° above the normal. After the 7th the temperature was almost continuously below the normal, and from the 19th to the 22nd, inclusive, the weather was unusually cold, the daily values being from 13° to 30° below the normal. The 4th was the warmest day, when the temperature was generally up to 60° or higher. The thunderstorm on Christmas night began in the late afternoon in the western part of the state, gradually moving eastward and passing over Des Moines between 8:00 p. m. and 9:00 p. m., and continuing until after midnight in the counties to the eastward. It was accompanied by rain, sleet and wind squalls. The rain froze as it fell and covered everything with a glaze of ice, which delayed railway and street car traffic and did much damage to telegraph and telephone lines. The small amount of corn in the fields at the end of November was gathered and cribbed during the first week of December and all farm work was finished for the season. The ice harvest began in many localities on the 26th.

*Pressure.*—The mean pressure (reduced to sea level) for the state was 30.02 inches. The highest recorded was 30.71 inches, at Davenport, on the 29th, and the lowest was 29.40 inches, at Sioux City, on the 2nd. The monthly range was 1.11 inches.

*Temperature.*—The mean temperature for the state, as shown by the means of 107 stations, was 18.7°, or 5.2° lower than the normal for Iowa. By divisions, three tiers of counties to the division, the mean temperatures were as follows: Northern, 15.1°, or 6.1° lower than the normal; Central, 19.1°, or 5.0° lower than the normal; Southern, 22.0°, or 4.4° lower than the normal. The highest monthly mean was 26.0°, at Keokuk, and the lowest monthly mean was 11.8°, at Inwood. The highest temperature reported was 67°, at Bloomfield, on the 3rd, Earlham, on the 4th, and Columbus Junction and Keokuk, on the 7th, and the lowest temperature reported was -25°, at Sibley, on the 20th, the range for the state being 92.

*Humidity.*—The average relative humidity for the state at 7 a. m., was 80.3 per cent, and at 7 p. m., it was 71.4 per cent. The mean for the month was 75.8 per cent, or about 3.7 per cent less than the normal. The highest monthly mean was 84 per cent, at Charles City, and the least reported was 69.4 per cent at Omaha.

*Precipitation.*—The average precipitation for the state, as shown by the records of 109 stations, was 1.04 inch, or 0.18 inch less than the normal. By divisions, the averages were as follows: Northern, 0.93 inch, or 0.69 inch less than the normal; Central, 1.09 inch, or 0.16 inch less than the normal; Southern, 1.04 inch, or 0.31 inch less than the normal. The greatest amount, 2.00 inches, occurred at Fort Madison, and the least, 0.25 inch, at Alta. The greatest amount in any 24 consecutive hours, 6.07 inch, occurred at Northboro, on the 25th.

*Snow.*—The average snowfall for the state was 6.7 inches. The greatest amount, 12.0 inches, occurred at Northwood, and the least, 0.5 inch, at Gilman. Measurable precipitation occurred on an average of six days.

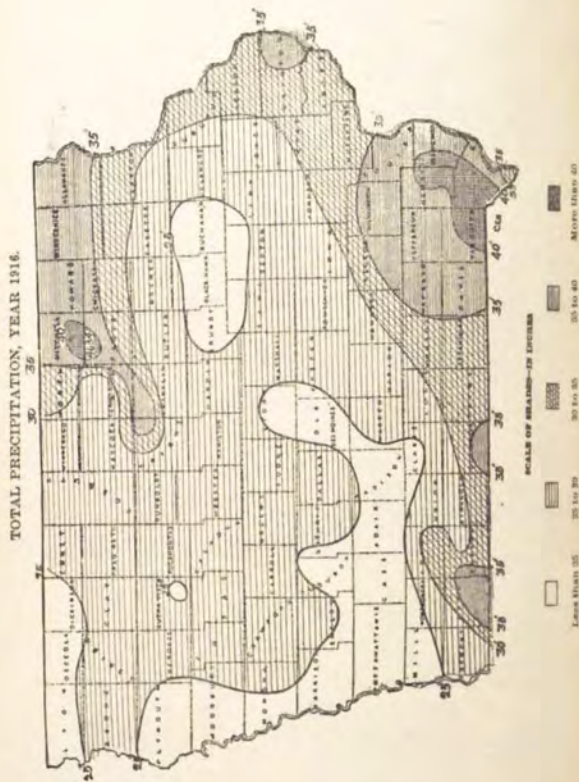
*Wind.*—The prevailing direction of the wind was from the northwest. The highest velocity reported was at the rate of 46 miles an hour from the northwest, at Sioux City, on the 16th.

*Sunshine and Cloudiness.*—The average percentage of the possible amount of sunshine was 57 per cent, or about 8 per cent more than the normal. The percentage of the possible amounts being: Charles City, 49; Davenport, 52; Des Moines, 59; Dubuque, 61; Keokuk, 55; Sioux City, 60, and Omaha, Nebr., 62 per cent. The average number of clear days was 15; partly cloudy, 8; cloudy, 8.

*Miscellaneous Phenomena.*—Dense fog occurred in the extreme eastern and southern counties on the 4th and 7th, and in most of the southern and eastern counties on the 26th. Lunar halos were reported on the following dates: 1st, 3rd, 9th, 10th, 11th, 15th; Solar halos, 9th, 12th, 15th, 16th, 17th, 21st, 22nd, 23rd; Sleet, 25th, 26th, 31st; Thunderstorms at a few scattered places in the southeastern portion of the state on the 4th, in the Mississippi River counties on the 7th, and very generally in all but the northeastern and extreme southeastern counties on the night of the 25th-26th.







## CLIMATE AND CROP REVIEWS

January was characterized by sudden and marked variations in temperature, excessive precipitation, the severe cold wave of the 12-13th, and a series of sleet and ice storms from the 25th to the 29th. An extreme instance of a marked change in temperature occurred at Davenport on the 5th when the temperature fell from 55° to 1°. With reference to precipitation, the month was decidedly the wettest of its name in the twenty-seven years' climatological history of the state. Every station in the state reported an excess of moisture, a fact in itself of note. Most of the precipitation was in the form of rain and sleet, and the fall of sleet was the heaviest in years, amounting to about an inch in some districts and was reported somewhere in the state on more than half the days of the month, culminating on the 28th and 29th in a fall of rain at temperatures below freezing. Up to that time the several accretions of sleet had formed a mass varying from half an inch to an inch in thickness, and this was converted by the freezing rain practically into a layer of ice that covered the entire landscape. Walking became hazardous and accidents as the result of falls occurred by the hundred. Many people were out skating on the golf links in Des Moines, and in the country districts men skated from farms to town. The cold wave of the 12th-13th was the severest since the memorable January of 1912.

Although colder than usual, February was a pleasant month, with fair, sunny weather predominating. The deficiency of temperature was due to continuous low readings during the first two weeks and during that period readings on several mornings were below zero; but, except in the extreme northwestern counties, no abnormally low temperatures occurred. From the 15th to the 25th the temperature was almost continuously above the normal and the weather was very pleasant, but the high temperature caused the snow to melt rapidly, resulting in high water in all streams. In some cases ice jams, damaged bridges and caused flooding of low lands.

March was somewhat milder and drier than usual, but these average conditions were not uniform over the state. In the extreme

eastern counties, the temperature was about normal, thence westward the excess increased until at the Missouri river it amounted to an average of 4° a day. The precipitation was below the normal, except over the southeastern and extreme eastern counties, where, in some localities, occurred the heaviest March precipitation of record, and most of it fell between the 21st and 26th. The fall at Washington during the time amounted to 5.56 inches. On the 26th the rainfall there was 4.41 inches, which compares with the heaviest 24-hour amounts liable to occur at any time of the year in Iowa. Another feature of the month was the unseasonably high temperature on the 12th over the southern half of the state. At Des Moines on that day the temperature rose to a higher degree (77+) than ever before recorded so early in the season. The warm weather started grass to growing, so that by the close of the month lawns were almost ready for mowing in southern sections. Spring seeding began in the southern counties, except over the wet sections of the southeast, but in the northern part of the state no field work was done.

April was cold, cloudy and showery, and as respects the growth of vegetation, backward. At the close of the month the season was one to two weeks late. In some localities in the northern sections oats seeding was unfinished at the close of the month, yet in other localities seeding was completed and some ground prepared for corn. In southern counties corn planting was in progress and fruit trees were beginning to bloom as far north as central Iowa. A storm of tornadic character did considerable damage to buildings in Wright County on the evening of the 19th.

With the exception of abnormally heavy rainfall in the southern counties, the average temperature and precipitation for May varied but slightly from the normal. Yet over large areas in the southern counties the monthly amounts of rainfall were in excess of 7 inches, and in parts of Des Moines, Lee and Van Buren Counties more than 9 inches fell. Frost did some damage on the 18th. On account of the wet weather a considerable corn acreage was unplanted at the close of the month, and much of the corn that was up could not be cultivated.

June was characterized by its persistent coolness and a severe rainstorm in the northeastern counties on the night of the 1st. It was the coolest June since state-wide observations were begun in 1890. The severe rainstorm will be described under the monthly summary for June. While the month was moderately dry over most of the State, the rains came at such timely intervals that no serious

effects of drought were felt in any section. The month closed with the highest temperature since the summer of 1914, and the backward corn made a remarkable response to the excessively warm and humid conditions.

July was warm and dry. The average temperature was 5.6° higher than the normal and readings above 100° were common on several days. The average precipitation was considerably less than one-half of the normal, and only six stations reported an excess. While showers came at rather timely intervals, especially during the first two decades of the month, the geographical distribution was decidedly irregular. In some localities moisture was needed early in the month, but actual droughty conditions did not set in until the last decade. At that time all vegetation was in urgent need of rain and potatoes, garden truck and pastures were suffering severely, while corn was imperiled. The extreme heat was trying to both man and beast. Many persons were prostrated, some fatally, and a large number of animals died. The conditions were, however, unusually favorable for harvesting and threshing, owing to the great number of clear, sunshiny days.

August was marked by a continuance, but in a modified degree, of the hot, dry weather that prevailed in July. The last decade was colder than usual, and light frost occurred at a few northern stations on the 27th-28th. There was 70 per cent of the normal precipitation, and most of this came during the first half of the month. The showers were of inestimable value to all growing crops and especially corn. In some sections, however, that crop had already been seriously damaged by dry weather. After the 15th but little rain fell in any part of the State until the last day of the month.

September, as a whole, was pleasant and favorable for crops and out-door occupations. Much plowing was done, except in the south-central districts, where the drought that began in July continued. Light to killing frosts occurred on the 15th and 18th, and killing frosts and freezing temperatures were almost general on the 29th. The bulk of the corn crop was mature at the time of the killing frosts, and the only injury done was to some of the late planted corn and mostly on low ground.

October was a typical autumn month, the average temperature, rainfall and sunshine approximated the normal very closely. The only feature out of the ordinary being a severe snowstorm on the

19th and 20th, when snow fell in all parts of the State except the extreme eastern counties. Several stations in the northwestern districts reported more than 5.0 inches of snowfall, and in numerous localities the drifts were several feet deep. This storm, together with frequent rains between the 20th and 28th, interfered with corn husking, which had begun earlier than usual. Husking was, however, resumed during the last few days of the month and 20 to 30 per cent of the crop had been gathered by the close of the month. Stock was in pasture, and in many localities flowers were in bloom at the end of the month.

Like the preceding month, November, as a whole, was a very pleasant autumn month, yet at times the conditions were unusual. The most marked feature being the cold spell from the 13th to 15th, inclusive, when the lowest temperature of record, for the first half of November, occurred at many stations. Heavy rains on the 7th-8th were followed by snow on the 11th-12th, but the remainder of the month was mostly bright and clear, making favorable conditions for all kinds of outdoor occupations. Practically all of the corn was harvested and considerable plowing was done.

The only marked variations from the normal for December were the unusually high temperatures during the first week, the almost continuous cold during the remainder of the month, and the thunderstorm on Christmas evening or night, which was accompanied by rain, sleet and wind squalls. The rain froze as it fell and covered everything with a glaze of ice, which delayed railway and street car traffic and did much damage to telegraph and telephone lines. The ice harvest began in many localities on the 26th.

#### WEATHER AND CROP BULLETINS.

Summaries of Weekly Bulletins Issued During the Season of 1916, for the Weeks Ending on Dates Given.

##### Bulletin No. 1, April 11, 1916—

With the exception of severe sleet and ice storms early in February, favorable conditions prevailed during the winter, and while cold weather, with freezing temperatures at night, has prevailed most of the time thus far this spring, farm work is progressing rapidly over the southern half of the state. Frost is not yet all out of the ground in the northern sections and the ground, in, in most places, too wet to work. The bulk of the small grain seedling is finished in the southern counties and considerable plow-grain seedling has been done for corn with the soil in excellent condition. Reports in Iowa has been done for corn with the soil in excellent condition. Reports vary as to condition of fall-sown grains, but there is no doubt but what the crops have been seriously damaged in many localities and the acreage of winter wheat has been greatly reduced. Many reports indicate 15 to

20 per cent damage and 25 to 50 per cent reduction in acreage. Cold weather has kept grass and fruit buds almost dormant. All live stock is in a healthy condition and the spring pig crop will be large. A good, warm rain would be very beneficial.

##### Bulletin No. 2, April 18, 1916—

The last week was exceptionally favorable for farm work. The average temperature was about 4 degrees above the seasonal normal and the rainfall, although light, was general and well distributed on Saturday night and Sunday. Early sown grain in the southern counties is up and shows a fairly good stand, but fall wheat is generally in poor condition as compared with the acreage and stand of a year ago. The high temperatures and drying winds during the first part of the week put most of the ground in the northern part of the state in good working condition and much seeding of spring wheat and oats was done. Plowing for corn is well advanced in southern districts and some potatoes have been planted. Since the warm weather and showers grass is making a good start, but more rain is badly needed. Fruit buds are still nearly dormant in the northern part of the state, but are in an advanced stage in southern counties and a few days will bring them into bloom. Apple, cherry, plums and other fruit promise a good crop of bloom. Spraying of tree fruits will begin in southern Iowa this week and continue northward next week. This is the important spray for apple scab.

##### Bulletin No. 3, April 25, 1916—

Another cold week has further retarded the growth of vegetation, but frequent and copious showers have been very beneficial to grass and small grain. The showers did, however, interfere with field work in many sections. Spring seeding is nearly finished and the early sown grain is up and shows a fair to good stand. Fall wheat is, in most sections, improving, but winter killing has been considerable, especially on north slopes, and the appearance of Hessian fly is reported in Madison county. Much plowing has been done preparatory to corn planting and some planting has been done in southern counties, where the work will become general during the coming week if favorable weather prevails. Fruit trees are in bloom near the Missouri border, with variable reports as to conditions and prospects, but mostly favorable. Much stock will be in pasture during the coming week.

##### Bulletin No. 4, May 2, 1916—

The weather continued too cool for normal growth, but was, in most sections, favorable for farm work, which progressed rapidly. Frost occurred on April 28th and May 2, with freezing temperatures in many localities on the latter date. Moderate to heavy rain fell in all parts of the state on Saturday and Sunday and will be of great benefit to meadows, pastures and small grain and will put soil in excellent condition for planting corn. All small grain except winter wheat is in fine condition. Reports vary as to condition of winter wheat, but, while there has been some winter killing and some fields have been plowed up for oats or corn, reports from many sections indicate a favorable condition. Pastures afford sufficient feed and much stock are now in grass and doing well. Cherry, plum and pear trees are in bloom over the southern half of the state and apple trees are beginning to blossom in the southern counties. The heavy to killing frosts on the last morning of the week will probably do much damage to fruit in bloom.

##### Bulletin No. 5, May 9, 1916—

The week was exceptionally favorable for farm work and the growth of vegetation. There was an average daily excess of temperature of about 4 degrees, and, while the rainfall was below the normal, the heavy and general rains of the previous week and the light showers on the 6th and 7th kept the ground in excellent tilth. Rapid progress was made in pre-

paring ground for corn and much planting was done in the southern and some in the northern sections. This work will be rushed during the coming week and with favorable weather the bulk of the crop will be in by the 15th and practically all of it by the 20th. Early planted corn is up in the southern counties. All small grain, meadows and pastures improved during the week but winter wheat is still below the normal. Truck crops are doing well. All tree fruits are in bloom, but apples are lighter than last year and peaches are practically nil. The frost on the 2d seems to have done but little damage. Stock in pasture and doing well.

#### Bulletin No. 6, May 16, 1916—

The week as a whole was cool and wet. Heavy rains fell in all parts of the state on the 13th and 14th. The amounts of rainfall ranging from one to more than four inches and averaging more than two inches, and as a result corn planting has been suspended, many streams are bank full and some lowlands are flooded. However, the first two days of the week were favorable for work and rapid progress was made in planting corn. Probably 60 per cent of the crop is planted and much of the early planting in the southern counties is up. The rains will be of great benefit to small grains, grasses, potatoes, fruits and all garden truck. Spring small grain is looking fine and doing well, but winter wheat is much below the normal, and many fields have been plowed up and the ground planted to corn. Pasturage is plentiful and all stock is now in grass.

#### Bulletin No. 7, May 23, 1916—

The week was unseasonably cool, the average temperature being about seven degrees below the normal. Frost occurred from one to three nights and ice formed in many localities on the morning of the 18th. The rainfall was ample in all districts and excessive in many localities, especially in north central and northwestern counties. Showers on the afternoon of the 21st were accompanied by destructive winds in portions of Polk, Jasper and Marion counties, and did considerable damage to trees and buildings. Rains have further delayed corn planting and plowing and cold, wet ground is causing slow growth of early planted and poor germination of late planted corn. Some replanting is being done on account of insect injury and poor seed. More winter wheat plowed or disked and ground planted to corn. Other small grain, grass and truck doing very well. Frost did some damage to tender vegetation and strawberries, but injury was generally slight and strawberries still give promise of big crop. Tree fruits generally good, but apples will be lighter than last year. Stock is thriving on pasture.

#### Bulletin No. 8, May 30, 1916—

The last seven days gave the first and only good "corn weather" thus far this season. The average temperature was about six degrees above the normal, and the rainfall was generally light, except over the southern tier of counties, east of Page county, where heavy rain fell on the night of the 23d, and again in the southeastern counties on the night of the 26th. The sunshine was much above the normal. With such favorable conditions the crops made rapid growth and much field work was done. Except in the southeastern counties, where it has been too wet, nearly all of the corn is up to the 12th to the 18th, when cold, wet weather prevailed, did not germinate well, and many of the fields have been or will be replanted. Cultivation has begun in early planted fields in all parts of the state and is becoming general in the central and southwestern districts. Grass, spring sown small grain, truck and all garden stuff looks very well. Rye is heading in the southern counties and winter wheat is beginning to shoot in the central sections. Alfalfa is nearly ready to cut. Hail, accompanying heavy rain in the southern counties, did considerable damage to cherries and some injury to strawberries, but there will be a big crop of berries and a fair crop of cherries.

#### Bulletin No. 9, June 6, 1916—

The average temperature for the week was about 3 degrees below the normal and the rainfall was generally light prior to the night of the 5th, except over the northeastern and north central counties, where heavy showers occurred on the night of the 1st. Showers were also general over the southern counties on the night of the 5th. Much damage was caused in the northeastern counties by excessive rains. Creeks were out of their banks, bridges washed out, lowlands flooded and hill land badly washed, but over most of the state the week was generally favorable for field work, and especially in the southeastern counties. Replanting and cultivation of corn progressed rapidly. The stand of corn varies from poor to good. Small grain continues in good condition and meadows and pastures are excellent. The first cutting of alfalfa has begun with heavy yield reported. Winter wheat is heading in central sections. Following is a summary of June 1st reports, showing average condition of crops on that date: Corn, 84 per cent; oats, 58; spring wheat, 36; winter wheat, 78; barley, 97; rye, 92; flax, 92; potatoes, 95; hay, 98; pastures, 102; alfalfa, 93 per cent.

#### Bulletin No. 10, June 13, 1916—

The first three days of the week were cold and showery, with heavy rains in the south and eastern counties, which further delayed plowing, planting, replanting and cultivation of corn in those sections. The remainder of the week has been much more favorable, the temperature has been nearly normal, with abundant sunshine. Except in the south and southeastern sections, rapid progress was made in cultivating corn. Most of it has been plowed once and much of it the second time. The replanted corn is up and shows a good stand generally. All small grain, grass, potatoes and garden truck are doing well. Clover and early potatoes are in bloom and oats will begin heading in the central counties during the coming week. Alfalfa is being harvested with good yields, and is being put up in good condition in the western districts, but is being cured with difficulty in eastern sections on account of wet weather.

On June 1st the average condition of live stock was as follows: Cattle and sheep, 99 per cent; hogs, 96; pigs and foals, 92, and horses, 94.

The secretary of the state horticultural society reports condition of fruit as follows: Apples, 51 per cent; American plums, 28; cherries, 50; grapes, 68; red raspberries, 62; black raspberries, 68; blackberries, 78; currants, 65; gooseberries, 66; strawberries, 84 per cent of a full crop. The average condition is 2 per cent less than last year, but apples are 20 per cent below the report of last year and strawberries are 12 per cent higher.

#### Bulletin No. 11, June 20, 1916—

The week was unseasonably cool with a decided deficiency of rainfall and an excess of cloudiness. The average daily temperature was about 6 degrees below the normal and the nights were especially cool. Though the rainfall was below the normal, showers were frequent, but not sufficiently heavy to interfere materially with farm work. The cultivation of corn was finished and in the southeastern counties planting and replanting was finished. The fields are now generally clean, but the crop is a week to ten days late. Over a large part of the state the second cultivation is nearing completion. Small grain is generally in good condition and doing well, but in some localities oats are yellow, and rust is reported in winter wheat in Marion and Madison counties. Early oats and barley are heading. First cutting of alfalfa secured in fine condition, except in eastern counties where wet weather did some damage. Potatoes and garden truck still doing well, but a good rain and warmer weather is needed for corn and truck, and rain would be highly beneficial to pastures, meadows, small grain and small and tree fruits. A fair crop of cherries is now being harvested.



**Bulletin No. 12, June 27, 1916—**

The week as a whole was cool, cloudy and showery, but the last three days gave much higher temperature and more sunshine. The average daily deficiency of temperature for the week was about five degrees, and, though showers were frequent, the rainfall was generally below the normal, except in the southern counties where there was an excess of moisture. Over the larger part of the state rapid progress was made in cultivating corn, and most of it has been plowed the second time and in a few localities the third cultivation has begun. The fields are generally clean, and the corn has a good color, but is small and backward. Some of the acreage intended for corn in the southeastern counties has not been planted on account of continued wet weather, and will be devoted to Sudan grass, millet or cowpeas. All spring-sown grains are generally in good condition and give promise of good yields, though in many localities oats are heading short. More reports are received of red rust in winter wheat in the southern counties. Some clover hay was cut. Potatoes are doing well, notwithstanding the fact that bugs are numerous. Several local wind squalls did considerable damage to small buildings and trees and blew off many apples and plums.

**Bulletin No. 13, July 4, 1916—**

The last seven days gave the highest temperature since the summer of 1914, and, as there was an abundance of sunshine the conditions were excellent for growth of corn and killing weeds. Only a few scattered showers occurred prior to the 4th, but on the last day of the week, local showers, some heavy, occurred in the central counties. Corn made very rapid growth and much of it is now nearly up to the normal. Many fields have been laid by and practically all of it is clean. Clover hay harvest is in progress and is being secured in prime condition. Some mixed hay has also been cut. Timothy is in bloom and will soon be ready to cut. The yield of clover is generally heavy, but timothy ranges from fair to good. Winter wheat and rye is ripening and harvesting will begin in the southern counties on or before the 8th. Oats and barley are also beginning to turn in the southern sections. As a whole small grain is generally good, but winter wheat is badly rusted in some localities and oats have headed short. Potatoes, truck crops and pastures are still in good condition, but rain would be beneficial and is badly needed in some localities.

**Bulletin No. 14, July 11, 1916—**

Continued hot and dry weather has been very favorable for finishing the cultivation of corn, haying and harvesting. The average temperature was about 1 degree above the normal in the eastern part of the state and from 2 to 3 degrees above in the western section. Only a few light and scattered showers occurred during the week, and the sunshine was excessive. Corn continued to make very rapid growth, and much of it is now up to the normal in size and has a strong, healthy appearance. Much clover and some timothy hay was put up in excellent condition. Winter wheat and rye harvest has begun in the southern counties, and early oats, fall wheat and rye are turning color in the northern part of the state. All garden truck, potatoes, pastures and fruit need rain and corn would be benefited by a good shower.

Following is a summary of July 1st crop report:

Acreage. Corn, 9,818,500 acres; oats, 4,979,800; winter wheat, 449,000; spring wheat, 143,000; barley, 197,000; rye, 55,800; flax, 5,400; potatoes, 101,400; tame hay, 3,240,600; wild hay, 508,500; alfalfa, 155,000; pastures, 9,717,000 acres.

Condition. Corn, 85 per cent; oats, 94; spring wheat, 92; winter wheat, 80; barley, 95; rye, 93; flax, 90; potatoes, 97; hay, 96; pastures, 100 per cent.

The secretary of the state horticultural society makes the following report on condition of fruit, July 1st: Summer apples, 43 per cent; fall

apples, 44; winter apples, 46; pears, 26; American plums, 47; domestic plums, 23; cherries, 35; grapes, 65; red raspberries, 63; black raspberries, 72; blackberries, 77; currants, 82; gooseberries, 69 per cent of a full crop. The indications are that the crop of apples would be 30 per cent less than in 1915, other crops about the same as last year.

**Bulletin No. 15, July 18, 1916—**

Another week of high temperatures and abundance of sunshine with local showers in nearly all parts of the state has kept corn growing very rapidly, and the crop is in fine shape. Tassels are beginning to show in haying and harvesting. All of the clover and much of the timothy hay was put up in excellent condition. Practically all of the winter wheat and early oats are in the shock in the southern counties and threshing has begun in a few localities. Harvest has also begun in the central and northern counties and will be general in all sections during the coming week. Late oats would be benefited by rain, and potatoes, pastures, blackberries, garden truck and tree fruits are in need of rain in many sections, especially in the southeastern counties. The daily maximum temperature ranged from 90 to 100 degrees.

**Bulletin No. 16, July 25, 1916—**

Another week with high temperatures and abundance of sunshine prevailing has been favorable for harvesting and threshing, which have progressed rapidly. It also has been favorable for the rapid growth of corn, which has now arrived at that stage of development when rain is essential. All of the early fields are in tassel and are shooting nicely. The color is still fine, and where showers have occurred the crop is in excellent condition, but the showers have been very local in character and in spots where no rain has fallen the leaves are beginning to roll badly. The lack of moisture is showing in the appearance and condition of pastures, late potatoes, truck, berries and apples. The small grain harvest is nearing completion in the southern counties and threshing returns as yet do not show more than average yield, but the quality is fine. Much timothy is being cut for seed, with heads well filled, and prospects favorable for a good yield.

**Bulletin No. 17, August 1, 1916—**

The daily mean temperature of the week was about 10 degrees above the normal and the daily maximum temperatures were near or above the 100 degrees. The rainfall was nil until July 31st or August 1st, when light to moderate and fairly well distributed showers occurred. Corn has generally held its own remarkably well and most of it retains its dark green, healthy color, but firing is noticeable on light soil and poorly cultivated fields. The local showers and somewhat lower temperature prevailing at the close of the week are timely and will be of great benefit to corn. Except for the intense heat and its effect on man and beast, the weather was fine for harvesting and threshing. Harvesting is finished in the southern and central counties and is well advanced in the northern districts. Threshing is being rushed, with generally satisfactory results, but the yields of small grain are variable. The yield of oats ranges from thirty to seventy-five bushels per acre; winter wheat, ten to thirty-five, and barley, twenty to thirty-five bushels per acre. Pastures are dry and late potatoes and truck have been badly damaged by drought and heat. Apples are falling badly in some sections. Many horses were overcome by the heat in the harvest fields. The second crop of alfalfa was secured in excellent condition.



Many silos were filled and much corn was cut and shocked for fodder. Stack threshing is nearing completion in the northern counties, potatoes are being dug, and much seed corn of excellent quality was gathered. The frost on the 15th did considerable damage to garden truck and to some late corn on low ground, but the bulk of the corn crop was fully matured and received no injury. Probably not more than ten per cent of the crop was damaged, and much of that not seriously. The amount of damage will be greatly lessened by the bright sunshine and fresh to brisk winds that have prevailed during the last week. Even the frosted corn is drying out rapidly. Fall-sown wheat is up in the northern counties and is growing nicely, but in the south-central counties the ground is still too dry to plow. In sections where plowing is possible the acreage of winter wheat will be increased over last year, but will not be as much as in 1914. Pasturage is generally in good condition, except in the south-central counties, and sufficient fall feed is assured. While some of the conditions were at times adverse to the best interest of the agriculturist, yet the year 1916 has been a profitable one and the final reckoning will show that Iowa has maintained her high standard of productivity.

#### IOWA CROP REPORT, JUNE, 1916.

Following is a summary showing the condition of crops on June 1st, as compared with the average of past years on that date:

Corn, 84 per cent; oats, 98; spring wheat, 96; winter wheat, 75; barley, 97; rye, 92; flax, 92; potatoes, 95; hay, 98; pastures, 102; alfalfa, 93 per cent.

The average condition of live stock was as follows: Cattle and sheep, 99 per cent; hogs, 96; pigs and foals, 92; and horses, 98 per cent.

The Secretary of the State Horticultural Society reports the condition of fruit as follows: "Apples, 51 per cent; pears, 37; American plums, 58; domestic plums, 30; cherries, 50; grapes, 67; red raspberries, 61; black raspberries, 68; blackberries, 78; currants, 65; gooseberries, 66; strawberries, 84 per cent of a full crop. The average crop condition for June this year is 53 per cent, a decline of 15 per cent from the May average, and 2 per cent below the average for June. Apples are 20 per cent below the report for June last year, and strawberries are 12 per cent higher; other fruits are in about the same condition as reported last year at this time."

Last year on June 1st the conditions were as follows: Corn, 87; oats, 97; spring wheat, 95; winter wheat, 96; barley, 95; rye, 96; flax, 95; potatoes, 96; tame hay and pastures, 97; wild hay, 96; alfalfa, 98 per cent.

#### IOWA CROP REPORT, JULY 1, 1916.

Acreage of Farm Crops and Estimated Condition of Staple Crops.

Reports received July 1st from township correspondents of the Iowa Weather and Crop Service show the following results as to the acreage and average condition of staple farm crops:

Corn.—As compared with the area reported by the township assessors for 1915, we have an increase of 70,500 acres, or a total of 9,818,500 acres. The average condition on July 1st was 85 per cent, or 6 per cent better than on July 1, 1915.

Oats.—Area sown, 4,9779,800 acres, which is nearly the same as the acreage sown in 1915, there being only 5,000 acres less this year than last year. The average condition is 94, compared with 98 per cent on the same date last year.

Wheat.—The area of winter wheat is 445,945 acres, or 138,000 acres less than in 1915. Spring wheat, 143,000 acres, or 5,000 acres less than last year. The estimated condition of winter wheat is 80 per cent and spring wheat 92 per cent, as compared with 97 and 96 per cent last year.

Barley.—Acreage sown, 197,000 acres; decrease, 5,700 acres; condition, 95 per cent; condition last year was 97 per cent.

Rye.—Acreage, 55,700; condition, 93 per cent.

Flax.—Acreage, 5,400; condition, 90 per cent.

Hay.—Acreage of tame and wild hay, 3,748,000 acres; condition, 96 per cent.

Alfalfa.—Acreage, 155,000; increase, 2,000 acres.

Pastures.—Acreage, 9,717,200; increase, 54,700 acres; condition, 100 per cent.

Potatoes.—Acreage, 101,400; increase, 1,800 acres; condition, 97 per cent.

Fruit.—The Secretary of the State Horticultural Society reports the condition of fruit on July 1st to be as follows: Summer apples, 42 per cent; fall apples, 44; winter apples, 46; pears, 26; American plums, 47; domestic plums, 28; Japanese plums, 20; cherries, 35; grapes, 65; red raspberries, 69; black raspberries, 72; blackberries, 77; currants, 62; gooseberries, 69 per cent of a full crop. The average of all fruits is 50 per cent; three per cent below the June average, and six per cent below the average for July last year. The indications are that the crop of apples will be 30 per cent less than in 1915; other crops about the same as last year.

#### IOWA CROP REPORT, AUGUST 1, 1916.

Following is a summary showing condition of crops on August 1st, as compared with the average of past years on that date: Corn, 90 per cent; pastures, 91; potatoes, 81; flax, 90. Last year on August 1st the condition of corn was 74 per cent; pastures, 108; potatoes, 102; flax, 94 per cent.

Preliminary reports show the average yield of winter wheat to be about 18 bushels per acre; spring wheat, 15; early oats, 37; late oats, 35; barley, 30; rye, 18 bushels; tame hay, 1.7 tons; wild hay, 1.4 tons. If these averages are maintained by final returns, the state will produce about 8,000,000 bushels of winter wheat; spring wheat, 2,140,000; oats, 180,000,000; barley, 6,000,000; rye, 1,000,000 bushels, and 6,000,000 tons of hay.

The report of the Secretary of the State Horticultural Society shows the condition of fruit on August 1st to have been as follows: Summer apples, 22 per cent; fall apples, 38; winter apples, 40; pears, 18; American plums, 37; domestic plums, 32; Japanese plums, 9; grapes, 52 per cent of a full crop.

The average for all fruits is 31 per cent, or 10 per cent below the average for the last fifteen years for August.

The grape crop is light in eastern Iowa, but nearly normal in the western sections; the quality will be better than last year.

The apple crop will be about one-half of what it was last year. Sprayed orchards will yield 30 to 60 per cent of a full crop, while neglected orchards will not produce more than 5 to 35 per cent of marketable fruit.

#### IOWA CROP REPORT, SEPTEMBER 1, 1916.

Following is a summary showing the condition of crops on September 1st, as compared with the average of past years on that date: Corn, 83 per cent; potatoes, 58; flax, 88; pastures, 77 per cent. On August 1st the conditions were: Corn, 90 per cent; potatoes, 81; flax, 90; pastures, 91 per cent. On September 1st, 1915, the conditions were: Corn, 66 per cent; potatoes, 94; pastures, 107 per cent.

Corn is very spotted, and the condition ranges from 25 per cent to 110 per cent, depending on the time of planting, kind and amount of cultivation, character of soil, and whether or not showers came at the critical stage of tasseling and shooting. When drought prevailed, and on sandy, light soil, and where not properly cultivated, the condition is poor. There are many barren stalks, and ears that started were poorly fertilized.

On the other hand, where planted early, on good soil, and where the showers were timely, the crop is in excellent condition. The general condition is much better in the northern half of the state than it is in the southern counties, although there are many small areas in the southeast and southwestern sections where the condition is up to above the average.

Preliminary reports indicate the average yield of winter wheat to be 17 bushels per acre; spring wheat, 14; oats, 37; barley, 30; rye, 18; timothy seed, 4.8 bushels per acre. The acreage of timothy cut for seed is 22 per cent greater than last year. Threshing was 85 per cent completed.

#### FINAL CROP REPORT OF THE STATE.

Total Yield of Soil Products and Value at Farm Price, December 1, 1916.

Following is a summary of reports from crop correspondents of the Iowa Weather and Crop Service, showing the average yield per acre and total yields of staple soil products, and the average price at the nearest station, December 1, 1916:

While the average and total yields of staple crops were not as great as in some of the previous years, on account of a marked deficiency of moisture in June, July and August, the value exceeds that of any year in the history of the state. The total value this year is \$597,165,673, or \$188,898,770 more than the value of the 1915 crop, and \$213,830,351 more than the average of the last ten years. This report does not include or take into consideration live stock, poultry or dairy products.

Corn.—Cool weather during May and June retarded the early growth

of corn, but this was balanced by the excessive heat in July and August. The lack of moisture during the earing period resulted in many barren stalks and imperfectly formed ears. With a normal amount of rainfall during July and August the yield would have been five to ten bushels more per acre. The weather during October and November was exceptionally favorable for drying out and gathering the crop, 93 per cent of which was in the cribs on December 1. The area planted this year was 9,813,500 acres, and the average yield was 35.3 bushels per acre, making the total yield 346,193,200 bushels. The average price at the nearest station on December 1st was 81 cents, and the total value, \$280,416,500.

Oats.—The estimated area harvested was 4,979,800 acres; average yield, 37 bushels; total yield, 184,131,000 bushels; aggregate value at 49 cents per bushel, \$90,234,190.

Spring Wheat.—Area harvested, 142,990 acres; average yield, 13.4 bushels per acre; total yield, 1,927,280 bushels; price per bushel, \$1.54; total value, \$2,969,011.

Winter Wheat.—The heavy sleet and ice storm in February seriously damaged winter wheat and completely ruined many fields, resulting in a great loss of acreage. The area harvested was 448,945; average yield per acre, 17.5 bushels; total yield, 7,858,900 bushels; average price, \$1.58 per bushel; total value, \$12,417,062.

Barley.—Average yield per acre, 30.7 bushels; total yield, 6,039,930 bushels; average price, 90 cents; total value, \$5,435,937.

Rye.—Average yield, 22.8 bushels per acre; total yield, 1,270,590 bushels; farm price, \$1.15; total value, \$1,461,178.

Flax Seed.—Average yield, 10.3 bushels; total yield, 56,015 bushels; total value, at \$2.06 per bushel, \$115,390.

Timothy Seed.—Area harvested 312,180 acres; average yield, 4.5 bushels; total yield, 1,404,810 bushels; total value, at \$2.18 per bushel, \$3,061,485.

Clover Seed.—Area harvested, 59,766 acres; average yield, 1.6 bushels; total yield, 95,625 bushels; value, at \$9.29 per bushel, \$888,356.

Potatoes.—The yield was greatly reduced by the drought in July, August and September, the average yield being 42.3 bushels; area harvested, 161,390 acres; total yield, 4,287,600; average price, \$1.75; total value, \$7,503,300.

Hay (tame).—Average yield 1.8 tons per acre; total yield, 5,929,720 tons; average price, \$9.00; total value, \$53,367,480.

Hay (wild).—Average yield, 1.4 tons; total yield, 734,377 tons; average price, \$7.89; total value, \$5,715,334.

Alfalfa.—Area, 154,880 acres; average yield, 4.4 tons; total yield, 688,047 tons; average price, \$11.71; total value, \$8,057,030.

	Acres	Average Yield	Average Price	Total Yield	Total Value
Corn	9,818,500	35.3 bu.	\$.91	346,195,300	\$ 280,416,528
Oats	4,979,900	27.0 bu.	.49	184,131,000	90,221,136
Spring wheat	142,900	13.4 bu.	1.54	1,927,260	2,599,611
Winter wheat	418,940	17.5 bu.	1.58	7,328,950	11,417,682
Barley	197,000	30.7 bu.	.50	6,036,900	5,428,667
Rye	55,745	22.8 bu.	1.15	1,270,500	1,491,178
Flax seed	5,445	10.3 bu.	2.03	55,915	116,286
Timothy seed	312,180	4.5 bu.	2.15	1,404,810	2,951,426
Clover seed	59,700	1.6 bu.	9.25	95,625	888,882
Potatoes	101,360	82.3 bu.	1.75	4,267,000	7,500,800
Hay (tame)	3,380,000	1.8 tons	9.00	5,925,720	52,307,400
Hay (wild)	97,407	1.4 tons	7.80	754,377	5,715,254
Alfalfa	154,889	4.4 tons	11.71	688,047	8,007,650
Pastorage and grazing				Estimated	96,000,000
Endlage				Estimated	6,000,000
Sweet corn				Estimated	98,000
Pop corn				Estimated	234,426
Fruit crop				Estimated	7,500,000
Garden truck				Estimated	4,700,000
Miscellaneous				Estimated	10,000,000
<b>Total</b>					<b>\$297,136,272</b>

The value of soil products for 1915 was \$298,196,942

## IOWA CROPS, 1916, NUMBER OF ACRES BY COUNTIES.

## PART I.

Counties	Corn	Oats	Winter Wheat	Spring Wheat	Barley	Rye
Adair	101,000	30,000	6,700	750	1,100	280
Adams	75,000	18,300	12,400	80	200	100
Albany	47,000	45,000	4,000	900	8,100	500
Appanoose	47,000	18,200	6,400	200	70	1,000
Audubon	90,000	38,200	2,500	2,100	6,200	30
Benton	130,000	70,700	700	480	6,200	550
Black Hawk	90,000	35,000	270	100	1,280	1,420
Boss	127,000	69,700	3,000	350	370	66
Bremer	61,400	52,500	350	200	1,000	900
Buchanan	100,000	56,000	300	210	640	800
Buena Vista	132,000	83,000	250	150	500	80
Butler	108,000	72,000	180	420	310	1,280
Calhoun	126,000	65,400	1,800	50	800	
Carroll	121,000	68,100	1,500	2,000	2,900	
Cass	107,000	33,600	22,000	2,300	2,300	
Cedar	165,000	36,300	1,800	400	9,000	700
Cerro Gordo	28,000	70,000	150	360	1,300	120
Cherokee	137,000	75,000	70	170	1,400	50
Chickasaw	70,000	67,000	300	1,500	2,800	400
Clarke	38,000	16,500	6,500	50	70	70
Clay	110,000	70,000	130	420	1,700	100
Clayton	76,000	67,000	1,300	600	5,400	1,000
Clinton	123,000	44,000	2,600	800	5,100	1,900
Crawford	150,000	66,000	1,900	5,800	2,800	40
Dallas	130,000	50,500	11,000	250	300	80
Davis	45,000	21,000	5,000	100	70	1,000
DeWitt	96,000	18,000	10,000	30	700	
DeWitt	91,000	51,200	150	200	4,200	2,300
Des Moines	71,000	23,000	6,600	350	20	2,000
Dickinson	38,000	38,000	100	600	1,000	
Dubuque	64,250	42,400	500	600	1,300	640
Emmet	70,000	53,000	100	300	100	
Fayette	90,000	61,900	400	900	2,000	900
Floyd	60,000	60,000	200	170	500	300
Franklin	115,000	82,000	150	300	120	
Fremont	111,000	10,000	16,000	500	60	200
Greene	123,000	64,000	1,000	40	200	
Grundy	70,000	70,000	750	150	1,800	60
Guthrie	107,500	45,800	5,500	1,100	600	10
Hamilton	134,000	86,300	300	300	100	
Hancock	134,000	84,000	50	1,100	1,800	250
Hardin	100,000	60,000	450	600	1,000	
Harrison	125,000	22,800	15,500	10,500	1,400	250
Henry	68,000	58,500	4,700	100	80	2,000
Howard	50,300	35,400	220	730	5,100	370
Humboldt	92,000	60,000	600	600	50	
Ia	50,500	51,000	600	600	2,500	
Iowa	101,000	36,400	2,000	600	800	400
Jackson	60,700	30,000	1,400	300	1,250	1,140
Jasper	145,000	13,400	8,000	2,400	150	
Jefferson	56,000	25,000	5,000	700	400	600
Johnson	101,000	30,500	2,000	300	800	1,100
Jones	76,500	32,000	200	400	2,300	800
Keokuk	97,000	24,500	3,700	2,300	140	1,170
Kossuth	160,000	141,000	140	500	1,000	140
Lee	56,200	19,100	9,200		340	6,500
Linn	114,000	52,000	500	540	770	1,070
Louis	65,500	20,000	5,800	100	100	2,800
Lucas	43,000	16,800	6,000	100	100	
Lyon	125,500	97,000	90	1,500	5,900	300
Madison	97,000	25,500	9,000	430	750	70
Mahaska	105,000	37,000	5,900	1,400	250	440
Marion	85,800	27,000	14,000	1,300	300	120
Marshall	124,000	69,000	1,000	500	600	80
Mills	101,000	14,500	13,000	1,000	250	200
Mitchell	72,000	77,500	280	1,320	2,200	60
Monona	146,100	30,000	24,000	9,100	1,280	150
Montrose	43,500	12,500	6,800	800	60	270
Montgomery	140,000	16,000	16,000	2,500	140	140
Muscatine	72,000	20,700	8,500	500	4,000	3,100
O'Brien	122,000	80,000		300	4,000	20
Osceola	84,000	65,000			2,700	80

## IOWA CROPS, 1916, NUMBER OF ACRES BY COUNTIES.

## PART I.

Counties	Corn	Oats	Winter Wheat	Spring Wheat	Barley	Rye
Page	100,000	20,000	17,700	1,900	250	600
Palo Alto	98,000	77,000		170	300	300
Plymouth	192,000	95,500	1,800	27,200	3,500	150
Pocahontas	130,500	89,300	100	80	200	200
Polk	100,000	30,000	19,000	1,700	30	100
Pottawattamie	201,000	43,000	25,000	4,800	6,000	300
Poweshiek	115,000	41,500	700	800	620	170
Ringgold	74,000	25,800	8,000		50	300
Sac	125,000	75,000	220	100	3,100	
Scott	80,700	25,500	8,200	600	19,200	2,300
Shelby	122,800	48,200	2,000	3,200	7,000	120
Sioux	117,000	101,000	700	11,600	13,400	90
Story	144,000	69,500	1,400	180	60	80
Tama	127,000	65,500	750	1,900	5,300	140
Taylor	82,200	23,500	11,600	150	500	500
Union	68,500	22,300	5,200	100	50	300
Van Buren	69,400	17,500	5,500	100	30	1,900
Wapello	57,400	17,000	6,000	200	100	1,000
Warren	81,400	30,000	24,000	500	300	400
Washington	97,700	43,500	3,700	240	370	740
Wayne	67,000	25,000	7,800	100	70	620
Webster	144,000	110,000	725	1,300	320	30
Winnebago	64,600	50,000	80	3,800	70	200
Winneshiek	87,000	66,400	500	4,200	10,500	470
Woodbury	208,000	66,300	7,600	4,300	1,400	100
Worth	55,000	66,000		2,000	2,400	100
Wright	119,500	77,500	400	500	800	
Totals	9,818,900	4,979,800	418,945	142,900	197,000	55,745

## IOWA CROPS, 1916, NUMBER OF ACRES BY COUNTIES.

## PART II.

Counties	Flax	Potatoes	Tame Hay	Wild Hay	Alfalfa	Pastures
Adair		900	40,000	1,800	250	123,000
Adams		280	26,100		850	102,700
Adair		970	49,000	940	100	174,800
Appanoose	5	950	41,200	300	80	118,000
Audubon		800	24,100	1,300	1,200	70,400
Benton		1,650	21,400	2,300	130	113,000
Black Hawk		1,280	22,800	7,300	190	87,000
Boone		1,560	27,000	4,200	470	79,900
Bremer		1,270	18,000	20,800	70	73,000
Buchanan		1,100	37,500	10,500	60	101,800
Buena Vista		1,100	25,000	9,500	120	72,000
Butler		1,800	25,200	2,800	70	93,200
Calhoun	20	100	22,300	5,400	250	64,400
Carrroll		1,900	29,000	9,000	820	74,200
Cass		1,080	36,300	980	1,150	102,200
Cedar		920	30,000	150	220	105,000
Cerro Gordo	280	1,220	28,200	9,000	270	66,300
Cherokee		1,300	28,000	5,000	1,250	77,000
Chickasaw	80	1,600	26,000	14,200	5	90,500
Clarke		1,000	35,000	200	100	94,000
Clay	170	800	25,000	13,000	6	75,000
Clayton		1,700	60,000	2,000	860	169,000
Clinton		2,000	28,000	1,900	900	120,000
Crawford		2,000	64,000	5,100	5,000	125,000
Dallas		540	27,000	2,500	740	108,000
Davis		370	42,000	4	130	130,000
Decatur		36,500	100		200	184,000
Delaware		1,100	45,500	5,300	90	119,000
Des Moines	300	800	22,000		750	91,000
Dickinson	300	1,250	13,000	12,000	120	41,500
Dubuque		2,100	61,500	700	210	148,800
Emmet	270	540	16,000	9,000	70	46,500
Fayette		1,500	25,000	9,400	100	154,000
Floyd	300	1,340	29,000	4,500	50	119,000
Franklin	50	1,280	22,000	9,400	110	80,300
Fremont		800	11,400	2,300	10,700	64,000
Greene		550	27,000	5,000	200	72,000
Grundy		1,620	26,800	6,600	60	71,000
Guthrie		600	34,100	2,600	320	107,000
Hamilton		720	39,000	7,400	810	74,000
Hancock	130	890	23,000	14,500	130	76,000
Hardin		920	26,000	6,600	160	76,000
Harrison		950	7,400		17,000	90,000
Henry		340	28,000		290	96,500
Howard	200	1,000	30,200	9,500	40	88,300
Humboldt	20	420	19,000	6,800	800	44,900
Ia		1,000	30,000	1,900	1,000	64,400
Iowa		1,220	38,000	350	140	101,000
Jackson		1,000	60,000	800	180	177,000
Jasper		950	49,000	570	380	145,000
Jefferson		1,000	35,000		50	93,000
Johnson		1,100	50,000	450	370	121,000
Jones		850	50,000	100	180	131,700
Knox		800	45,400		800	122,000
Kossuth	480	1,500	22,500	25,000	340	119,500
Lee		1,190	22,200	20	500	133,500
Linn		1,900	53,500	2,400	200	129,500
Louis		420	19,700	190	320	67,200
Lucas		180	31,700	75	60	101,000
Lyon		2,100	16,000	9,400	2,400	66,500
Madison		1,100	22,000	850	270	120,000
Mahaska		260	20,000	290	430	112,000
Marion		860	31,200	240	650	121,500
Marshall		1,250	20,000	330	170	84,000
Mill		600	12,800	2,200	11,000	61,500
Mitchell	500	2,700	20,000	2,500	70	90,000
Monona		620	11,400	11,000	12,800	96,700
Monroe		120	40,000		80	194,000
Montgomery		880	28,000	600	4,600	77,200
Muscatine		25	25,400	620	2,000	82,400
O'Brien	50	1,400	36,500	7,200	1,000	71,000
Osceola	100	1,000	18,700	7,200	180	43,200







## TABULATED CROP SUMMARY FOR THE YEAR 1916.

## PART II.

Counties	Rye		Flax Seed		Potatoes		Hay--Tame		Hay--Wild		Alfalfa	
	Bushels per acre	Total Bushels	Bushels per acre	Total Bushels	Bushels per acre	Total Bushels	Tons per acre	Total Tons	Tons per acre	Total Tons	Tons per acre	Total Tons
Mitchell.....	20	1,200	11	5,500	44	118,800	2.0	22,000	1.5	3,900	2.7	190
Monona.....	19	2,700	.....	.....	66	42,800	1.9	21,700	1.6	18,600	3.8	47,500
Monroe.....	12	3,200	.....	.....	63	8,200	1.4	56,000	.....	.....	3.0	240
Montgomery.....	15	2,100	.....	.....	61	53,700	1.6	44,800	1.5	900	3.4	15,000
Muscatine.....	20	22,000	.....	.....	38	68,400	1.4	35,600	1.0	620	3.5	8,500
O'Brien.....	19	380	12	800	41	59,400	2.2	588,000	1.7	12,200	2.8	8,800
Oceola.....	12	900	7	1,150	62	62,000	1.7	36,700	1.5	10,800	3.0	840
Page.....	20	12,400	.....	.....	74	51,800	1.9	69,500	2.0	2,200	3.3	11,600
Palo Alto.....	20	7,200	10	6,200	38	29,600	1.2	21,000	1.1	25,500	3.0	720
Plymouth.....	18	12,200	12	600	45	79,200	1.5	37,800	1.2	25,000	3.5	36,000
Pocahontas.....	27	6,500	9	700	53	22,500	1.5	27,800	1.2	14,000	2.5	650
Polk.....	18	1,800	.....	.....	39	62,400	1.7	44,200	1.0	2,300	3.8	3,400
Pottawattamie.....	22	6,600	.....	.....	59	123,900	1.5	37,800	1.3	10,200	3.4	68,000
Poweshiek.....	15	2,400	.....	.....	23	23,500	2.0	86,400	1.7	270	2.8	620
Ringgold.....	15	4,500	.....	.....	51	19,200	1.6	67,200	1.0	100	3.5	6,700
Sae.....	.....	.....	10	400	33	31,500	1.6	49,600	1.2	6,600	4.0	2,800
Scott.....	18	41,400	.....	.....	51	178,500	1.6	55,500	1.0	1,800	4.2	51,200
Shelby.....	30	3,900	.....	.....	41	72,800	1.2	48,200	1.5	6,200	2.3	8,000
Sioux.....	18	1,050	.....	.....	49	107,800	1.8	38,300	1.5	22,800	2.9	12,000
Story.....	18	1,400	.....	.....	79	29,500	1.6	48,800	1.2	4,200	5.0	2,600
Tama.....	22	3,100	.....	.....	24	32,200	3.0	110,000	1.5	1,900	3.4	850
Taylor.....	22	12,300	.....	.....	21	44,500	1.8	61,200	1.0	440	2.0	1,400
Union.....	18	3,600	.....	.....	50	35,000	1.8	44,600	1.5	870	3.0	600
Van Buren.....	13	24,700	.....	.....	29	5,500	1.5	54,000	1.0	30	2.5	1,600
Wapello.....	13	15,000	.....	.....	25	37,700	1.4	42,000	1.0	200	6.0	1,500
Warren.....	19	7,600	.....	.....	41	29,000	1.5	54,000	1.0	380	2.8	800
Washington.....	16	11,800	.....	.....	40	27,200	1.5	61,800	1.5	12	2.4	340
Wayne.....	12	5,000	.....	.....	59	11,800	1.6	75,200	1.5	75	2.5	430
Winnebago.....	18	540	12	1,700	35	25,500	1.9	49,400	1.6	2,400	2.5	1,100
Winnesbago.....	16	1,120	13	5,000	50	50,000	1.6	39,900	1.8	28,200	2.6	230
Winneshiek.....	17	8,000	10	1,000	54	44,200	2.0	103,200	1.6	6,900	2.0	500
Woodbury.....	18	1,800	.....	.....	50	85,000	1.7	46,300	1.2	11,400	3.1	53,300
Worth.....	8	800	.....	.....	10	9,600	4.5	36,000	1.7	37,400	1.5	23,000
Wright.....	17	340	10	700	31	18,400	1.6	42,400	1.1	7,700	4.2	840
Total.....	22.8	1,270,500	10.3	56,015	42.3	4,287,000	1.8	5,929,720	1.4	724,377	4.4	688,947

## FUNGUS DISEASES OF PLANTS FOR 1916

BY L. H. PAMMEL

The past year has been, on the whole, a good one for crops, as shown by the crop report of Dr. Chappel. The tables and charts showing temperature and precipitation at Ames and for the state, which have been compiled for me from the reports of the Iowa Weather and Crop Service, by Miss Charlotte M. King, show that there were deficiencies in precipitation at Ames in all months, March to September, inclusive, the greatest deficiencies occurring in March, 1.17 inches; June, 1.69 inches; and July 3.54 inches. These data are graphically represented by the tables and charts accompanying this article.

Dr. George M. Chappel gives the following yields; corn, 346,193,200 bushels, having a value of \$280,416,500. The loss from corn smut at 6 per cent would mean a loss of \$18,000,000 in round numbers. The oat crop amounted to 184,131,000 bushels with a value of \$90,224,100. The loss from both kinds of oat smut is about 7 per cent. This would mean a loss of about \$6,300,000. Corn ear rots cause a loss of about 2 per cent, which would mean a loss of \$5,600,000. Crown gall has been estimated to have damaged nursery stock about \$45,000 annually. The loss from apple scab is nearly \$2,500,000. The alfalfa spot disease has damaged the crop in Iowa about \$1,000,000. A conservative estimate places the damage to crops of all kinds from fungus diseases in Iowa not far from \$35,000,000. The damage to our crops is in a large measure controlled by weather conditions. Much of the injury to our crops can be prevented by treatment with fungicides and crop rotation.

We may briefly summarize the disease as follows: During the year 1915 there was an abundance of the potato blight fungus (*Phytophthora infestans*) which was, undoubtedly, due to the great precipitation and the unusually low temperature. The disease appearing from early August to the middle of the month. The year 1916 was on the whole characterized with high temperature, low humidity and small precipitation. This period of drought began in the month of June and continued to September. The potato blight fungus (*Phytophthora infestans*) did not occur in the state this season.

Leaf rust of oats (*Puccinia coronata*) was not severe. It made its first appearance early in June. The dry weather checked its development. The crop was good and the quality of the grain excellent. Stem rust of oats (*Puccinia graminis*) occurred to some extent, but not serious. Stem rust of wheat (*Puccinia graminis*) was not common and little damage was done.

Leaf rust of rye (*Puccinia rubigo-vera*). The leaf rust on rye was common and did some damage. In black soil it was much more common than in sandy soil. The damage was not as great as in 1915. It was common on rye.

Corn rust (*Puccinia sorghi*). This rust, though common on leaves of corn, injured the corn somewhat. The uredo stage occurs toward the latter part of July and early August. The aecidium stage was not observed. The disease is widespread in Iowa and is more injurious to sweet corn than field corn.

Clover rust (*Uromyces Trifolii*) was not common and only occurred on second crop clover late in the season.

Alfalfa rust (*Uromyces Trifolii*) was not common.

Asparagus rust (*Puccinia asparagi*) was widely distributed, though not as common as the year previous.

Apple rust (*Gymnosporangium macropus*), though widely distributed, was not severe as the previous season because the infection period for the red cedar was shortened.

Two important rusts must be reported this year: the hollyhock rust (*Puccinia malvacearum*), reported for the first time by a correspondent in Tama county. The writer has looked for it for some years in Iowa, but without finding it. It is said to occur in Wisconsin.

Snap dragon rust was reported from Scott county.

Another rust (*Uredo Campaulae*) was reported from Bagley also for the first time.

Timothy rust (*Puccinia Phlei-pratensis*) was not common.

Wheat blight (*Fusarium culmorum*) was not common.

Sorghum blight (*Bacillus Sorghi*) was fairly common.

Oats smut (*Ustilago avenae* and *U. laevis*). These smuts were fairly abundant and damaged the oat crop to a considerable extent. The loss to the crop has been estimated at \$5,300,000. Farmers do not distinguish between the two species. The loose smut (*U. avenae*) was somewhat more abundant than the covered smut (*U. laevis*). Loose Smut of Wheat was common and injurious.

Bunt (*Tilletia foetens*) was not common; found only in Davis County. It probably occurred in other wheat sections of Iowa.

Rye smut (*Urocystis occulta*). Rye is not grown extensively in Iowa. Chiefly in the sandy region of eastern Iowa. This smut was not uncommon in Davis County.

Corn smut (*Ustilago zeae*) found everywhere in Iowa. The amount of injury to the crop varies in different localities. The damage to the crop varies greatly. In some fields as much as 10 to 15 per cent of the corn stalks show corn smut. On such stalks the ears are generally smaller and in some cases the stalks are barren. Only about 1 per cent of the ears show corn smut.

The two barley smuts, the naked (*Ustilago nuda*) did an estimated damage of 3 per cent, and the covered smut (*U. hordei*) 2 per cent. Few of the farmers of the state treated their seed. This is in strong contrast to the custom of the onion growers of Scott County who treat their seed regularly with formalin by the drip method so that little of the onion smut (*Urocystis cepulae*) was reported.

Smut on poppy (*Entyloma papaveris*). A number of years ago, about 1910, the writer observed in a flower garden in La Crosse, Wisconsin, an

abundance of *Entyloma* on the cultivated European poppy. This year it was found abundantly after a rain on the same species of poppy in Steamboat Rock, Hardin County. The majority of the leaves on a small patch were infected.

Cabbage yellows (*Fusarium gentianus*). Cabbage yellow, for a number of years has been noted as a destructive disease in the cabbage district of Muscatine. Dr. I. E. Melhus reports the loss as serious.

Black rot of cabbage (*Pseudomonas campestris*) was not common.

Clover anthracnose (*Gloeosporium trifolii*). This disease attacks the peduncle of the clover; causes the stem near head to break so that no seed is produced. This disease was common in many parts of Iowa. This disease was first reported in June in Iowa by Dr. I. E. Melhus, the first time it has been reported in the state. It was also common in Illinois where Mr. Mosher found it, specimens of diseased plants having been forwarded to me and identified by Dr. Melhus.

Alfalfa leaf spot (*Pseudopeziza medicaginis*) was fairly abundant in May. The dry weather of June seems to have checked the disease somewhat. It did some damage later in the season though not as severe as in 1915.

The violet root fungus (*Rhizoctonia medicaginis*) continues to spread slowly in Scott County.

Crown gall (*Bacterium tumefaciens*) seems to be on the increase in Iowa.

The Illinois Canker or Blister Canker (*Nummularia discreta*) is increasing in Western Iowa and spreading northward. It has been reported from Floyd, Wright and Scott counties by Dr. Melhus.

Apple blight (*Bacillus amylovorus*) was not abundant this year. Some trees were blighted early in June; then the disease was checked when the dry period of June started.

Apple scab (*Fusicladium dendriticum*) was widely distributed in Iowa. The leaves were not so seriously diseased as in 1915. There was however, considerable fruit diseased. Professor Laurenz Green, who has been conducting some co-operative spraying experiments, reports that unsprayed fruits of Northwestern Greening in Webster County had one per cent of clean apples. The untreated apples in the Bagley experiments had 10-15 per cent clean.

Yellow leaf disease of barley (*Helminthosporium graminum*) was abundant in places where barley is grown. It is an abundant crop in north-eastern Iowa. The earliest report of the disease was June 21st and the damage reported was 5 per cent. The spot disease of barley (*H. sativum*) also on barley occurring on the leaves was less destructive. About three per cent damage is reported.

Ergot (*Claviceps purpurea*) was common on rye, also abundant on wild rye and quack grass.

The spot disease of cherry (*Cylindrosporium padi*) though occurring in nurseries was not as severe as in 1915. Very few of the leaves of orchard trees dropped.

The cherry mildew (*Phodosphaera Ozyacanthae*) was common though less injurious than the season previous. The same may be said for the lilac mildew (*Microsphaera alni*). It is interesting to note that this fungus seldom occurs on the Persian lilac.

The rose mildew (*Sphaerotheca pannosa*) was common only on Crimson Rambler. Very little of the gooseberry mildew was observed.

The corn disease (*Fusarium moniliforme*). From one to two per cent of the ears of corn were affected by the fungus. It was observed in a few cases on the roots. However, none of the plants were broken as was previously observed. It is probable that different seasons influence the development of this facultative parasite. Attention should be called to an oversight in our paper on Fusarium on corn to which Dr. C. W. Carpenter has called my attention. Professor Sheldon describes this species in the Report of the Nebraska Experiment Station for 1904 with figures showing the moniliform microconidia.

Cucumber wilt (*Bacillus tracheiphilus*) appeared in a cucumber patch in Ames in 1916. It was observed in a commercial greenhouse in Council Bluffs in 1915. It was also observed this year in Muscatine by Dr. I. E. Melhus.

Lettuce mildew (*Bremia lactucae*) was abundant in commercial greenhouses in Nevada and Des Moines, according to Dr. I. E. Melhus. It was not observed on lettuce in the garden.

Downy mildew (*Sclerospora graminicola*) was found in a few places on nearly mature plants. Not as abundant as in 1915.

Blisters of the White pine did not occur either on cultivated or mature white pine on the currant in Ames or in any other part of the state.

Rust of gooseberries (*Aecidium grossulariae*) was abundant on wild species of gooseberries in the vicinity of sedges (*Carex*).

Downy mildew of the grape (*Plasmopara Viticola*) was widely scattered but not abundant. The powdery mildew (*Uncinula necator*) was also widely scattered, but not serious. Of the diseases on forest trees the leaf spot of the Ohio Buckeye, *Phyllosticta Paviae*, was observed in Boone and Story counties, though not as abundant as in 1915. The oak blight, *Gloeosporium*, was not common. In 1915 it was severe on the white oak. The sycamore blight was not common. The black walnut blight (*Marsonia juglandis*) which frequently causes the leaves to fall during the late summer was not uncommon this year but did not cause the early defoliation of the tree, as in some years.

The spot on hickory was fairly common.

The black knot of the plum (*Plowrightia morbosa*) not observed on the cultivated American plum, though occasionally on the wild plum of the same species. It was more frequent on the choke cherry. It is common on plants around the lakes of northern Iowa.

Enlarged plum (*Exoascus communis*) was noticed in a few cases on the Miner plum. The plum pocket (*E. pruni*) was reported from Hancock county on the cultivated plum by Dr. Melhus.

Cottonwood rust (*Melampsora tremulae*) was widely scattered and common only in the autumn.

The absence of Phytophthora has been noted. Dr. Melhus reports the following diseases to me: Jelly end rot (*Fusarium radicolica*) which he observed in three counties; Early Blight (*Alternaria solani*) also in a number of counties; Blackleg (*Bacillus Phytophthorus*) in Story and Scott counties. Potato scab was widely scattered.

Melon anthracnose (*Colletotrichum lagenarium*) was widely scattered but not common.

The spot on tomato (*Septoria Lycopersici*) so common in 1915, was not observed to any extent this year. Dr. Melhus reports tomato mosaic from Scott county, the first time it was observed in the state.

The strawberry leaf spot (*Microsphaerella Fragariae*) was fairly common in old strawberry beds.

#### FUNGICIDES.

In view of the widespread damage resulting from the various diseases of our cultivated plants, it was thought to be appropriate to append here a brief note relative to means of combatting these diseases. The common fungicides are as follows:

1. Bordeaux Mixture, one of the standard formulas for which is: copper sulphate, four pounds; quick lime, four pounds; water, fifty gallons.

2. Formaldehyde is a forty per cent solution is a general fungicide for treating oat smut and onion smut. In the case of onion smut the drip method is used and the usual formula is one pint to every twenty-five to thirty-three gallons of water.

There are several combinations of Bordeaux Mixture and formalin. In some cases insecticides are added to destroy the insects. The best treatment for oat smut is the formalin method. Lime sulphur is also used to a considerable extent. The different methods of treatment are set forth in a number of publications from among which the following are recommended:

Shelby, A. D.: A Brief Handbook of the Diseases of Cultivated Plants. Bulletin of the Ohio Experiment Station, No. 214, pp. 355-360.

Beach, S. A.: Spraying Practice for Orchard and Garden. Bulletin of the Iowa Experiment Station, No. 127, pp. 73-77.

## WEATHER DATA, SHOWING SEASON, 1916--AMES, IOWA.

Date	April			May			June			July			August			September		
	Max.	Min.	Precip.	Max.	Min.	Precip.	Max.	Min.	Precip.	Max.	Min.	Precip.	Max.	Min.	Precip.	Max.	Min.	Precip.
1	83	58		83	38	.03	74	53	.07	84	57		86	63	.06	81	55	
2	85	59		82	38		74	54		84	56		86	63		82	56	
3	86	59		82	38		71	54		84	56		86	63		82	56	
4	86	59		82	38		71	54		84	56		86	63		82	56	
5	84	59		84	43		72	54	.02	80	56	T.	80	56	.14	83	60	
6	88	58		84	43		67	52	.02	80	56		83	56		83	57	
7	84	58		84	43	.15	69	53	.05	83	56		83	56		83	56	
8	84	58		84	43		73	55		80	56		84	56		84	56	
9	87	58		84	43		81	56		80	56		84	56		84	56	
10	87	58		84	43		81	56		80	56		84	56		84	56	
11	87	58		84	43		81	56		80	56		84	56		84	56	
12	87	58		84	43		81	56		80	56		84	56		84	56	
13	87	58		84	43		81	56		80	56		84	56		84	56	
14	87	58		84	43		81	56		80	56		84	56		84	56	
15	87	58		84	43		81	56		80	56		84	56		84	56	
16	87	58		84	43		81	56		80	56		84	56		84	56	
17	87	58		84	43		81	56		80	56		84	56		84	56	
18	87	58		84	43		81	56		80	56		84	56		84	56	
19	87	58		84	43		81	56		80	56		84	56		84	56	
20	87	58		84	43		81	56		80	56		84	56		84	56	
21	87	58		84	43		81	56		80	56		84	56		84	56	
22	87	58		84	43		81	56		80	56		84	56		84	56	
23	87	58		84	43		81	56		80	56		84	56		84	56	
24	87	58		84	43		81	56		80	56		84	56		84	56	
25	87	58		84	43		81	56		80	56		84	56		84	56	
26	87	58		84	43		81	56		80	56		84	56		84	56	
27	87	58		84	43		81	56		80	56		84	56		84	56	
28	87	58		84	43		81	56		80	56		84	56		84	56	
29	87	58		84	43		81	56		80	56		84	56		84	56	
30	87	58		84	43		81	56		80	56		84	56		84	56	
31	87	58		84	43		81	56		80	56		84	56		84	56	
Mean	87.8	56.7		81.3	46.8		76.6	54.6		84.2	64.5		86.0	58.9		81.0	49.2	

## MEAN TEMPERATURE AND TOTAL PRECIPITATION

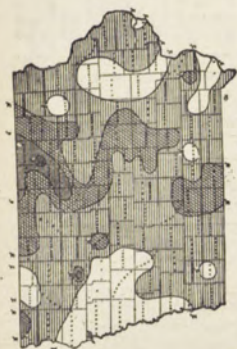
With Departures From the Normal--Ames, Iowa

	April		May		June		July		August		September	
	Mean Temp.	Total precip.	Mean Temp.	Total precip.	Mean Temp.	Total precip.	Mean Temp.	Total precip.	Mean Temp.	Total precip.	Mean Temp.	Total precip.
Monthly -----	47.2	2.77	49.0	4.02	65.3	2.85	79.4	0.80	72.4	3.73	61.6	3.80
Excess (+) or deficiency (-),	- 2.4	-.09	- 2.2	-.75	- 3.9	-1.60	+ 5.4	-3.51	+ 0.1	-.08	- 1.8	-.08

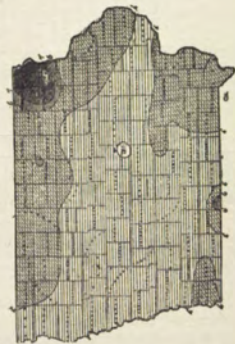
## STATE OF IOWA

Monthly -----	47.1	2.62	66.9	4.06	64.5	3.71	79.7	1.78	74.0	2.58	62.5	3.80
Excess (+) or deficiency (-),	- 1.6	-.24	- 0.6	+.36	- 4.6	-.67	+ 5.6	-2.18	+ 2.2	-1.10	- 1.1	+.30

Average precipitation for the season March to September, inclusive, was 21.08 inches for the state; deficiency, 5.67. Mean temperature for the same period, 60.4°; excess, 6.3°.



Less than 2 to 2 2 to 4 4 to 5 More than 5



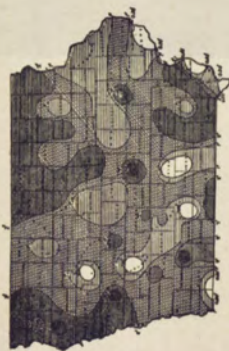
Less than 2 2 to 4 4 to 6 6 to 7 More than 7



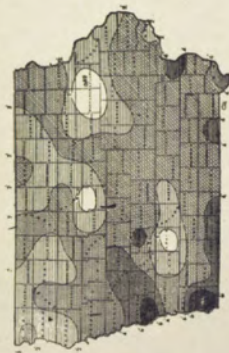
Less than 1 to 2 2 to 4 4 to 5 More than 5



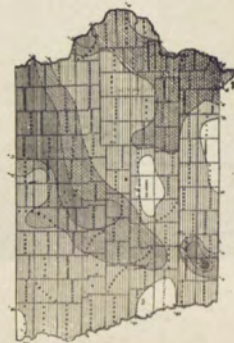
Less than 2 2 to 3 3 to 5 5 to 7 7 to 9 More than 9



Less than 0.50 1 to 2 2 to 4 4 to 6 More than 6



Less than 1 1 to 2 2 to 4 4 to 6 More than 6



Less than 2 2 to 4 4 to 6 6 to 8 More than 8