

UNITED STATES
DEPARTMENT OF AGRICULTURE,
WEATHER BUREAU.

ANNUAL REPORT

OF THE

Iowa Weather and Crop Service

FOR THE YEAR 1896.

JOHN R. SAGE,
Director.

GEO. M. CHAPPEL, M. D.
*Local Forecast Officer, U. S. Weather Bureau,
Assistant Director.*

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STATE OF IOWA,
OFFICE OF THE WEATHER AND CROP SERVICE, }
DES MOINES, April 15, 1897.

To His Excellency, Francis M. Drake, Governor of Iowa:

SIR—In accordance with the requirements of the law, we have the honor to submit herewith the seventh annual report of the Iowa Weather and Crop service for the year 1896. We are, sir, very respectfully,

Your obedient servants,

JOHN R. SAGE,

Director.

GEO. M. CHAPPEL, M. D.,

Local Forecast Official, U. S. Weather Bureau,

Assistant Director.

ANNUAL REPORT, 1896.

This service has made a steady and substantial growth during the year covered by this report; and there has been a very gratifying increase in the public interest in relation to the scientific and economic data collected and tabulated by the aid of the efficient and public spirited corps of meteorological observers and crop correspondents, whose fidelity is gratefully acknowledged and appreciated.

This is an age of statistics, and the value of reliable data of the climatic conditions and crop productions of any portion of our great country is recognized by scientists, statesmen and business men of all classes. In this leading agricultural state we are making progress, both in the scientific study of the climate and in a practical knowledge of the almost limitless resources of crop production of our fertile soil.

By the co-operation of the State Weather and Crop Service and the National Weather Bureau the results achieved are much more valuable than could be secured without such unity in the work. The efficient chief of the U. S. Weather Bureau, Prof. Willis L. Moore, has placed the officers of the state service and the people of Iowa under heavy obligations by making every effort in his power to disseminate the daily forecasts to all localities that may be reached by wire or mail. At this time the number of forecasts sent to Iowa postoffices by mail exceeds 1,000; and by telegraph 103 places are recipients of these benefits. Many of these towns served by wire are distributing stations whence postal cards are sent to the towns that may be served by earlier mails.

There is a steadily increasing demand for copies of the Monthly Review and the Weekly Weather Crop Bulletins issued by this service. During the year the number of copies of the Review amounted to over 80,000; and the issue of Bulletins was about 2,200 per week, from April to October.

The records of the local stations of this service have been called into courts quite frequently as evidence in the trial of cases wherein questions of fact arise in relation to meteorological conditions on certain dates or specified times. In many instances the testimony thus obtained from these official

figures and notes, made by trained observers by the aid of the best instruments obtainable, have been found to be of inestimable value.

There are connected with this service 123 meteorological stations, of which number 116 report temperature and rainfall, and 7 rainfall only. The observers at 77 of these stations are supplied wholly or in part by state instruments.

METEOROLOGICAL STATIONS AND OBSERVERS.

STATIONS.	OBSERVERS.	STATIONS.	OBSERVERS.
Adair.....	F. L. Morrison.	Keosauqua.....	Prof. J. H. Landes.
Afton.....	Hon. N. W. Rowell.	Knoxville.....	Casey and Reaver.
Algona.....	C. D. Pettibone.	Le Claire.....	River Observer.
Alta.....	D. E. Hadden.	Lansing.....	G. H. Markley.
Alta (near).....	W. J. Minard.	Larchwood.....	E. W. Stokes.
Amana.....	Conrad Schadt.	Larrabee.....	H. B. Strever.
Ames.....	Exp. Station.	Lenox.....	J. L. Hurley.
Atlantic.....	J. W. Love.	Le Mars.....	Dr. T. E. Cole.
Atlantic.....	Geo. W. Franklin.	Linn Grove	
Audubon.....	F. P. Hocker.	(Mt. Vernon).....	Rev. J. W. Hubbard.
Belknap.....	A. W. Rankin.	Logan.....	Mrs. M. B. Stern.
Belle Plaine.....	S. P. Vandike.	Malvern.....	E. F. Norton.
Bonaparte.....	Hon. B. R. Vale.	Maquoketa.....	Dr. A. B. Bowen.
Britt.....	G. P. Hardwick.	Mason City.....	H. I. Smith.
Carroll.....	Moses Simon.	Marshalltown.....	C. M. Cook.
Cedar Falls.....	Prof. A. C. Page.	Maxon (Albia).....	Gus Johnson.
Cedar Rapids.....	Elec. Light & Power Co.	Millman.....	W. H. Shaul.
Centerville.....	Prof. H. E. Reister.	Mocar.....	E. G. Thomas.
Chariton.....	Hon. S. H. Mallory.	Monticello.....	Henry D. Smith.
Charles City.....	J. W. Smith.	Mt. Vernon.....	Prof. A. Collins.
Clarinda.....	A. S. Van Sandt.	Mt. Ayr.....	J. W. Beard.
Clinton.....	Luke Roberts.	Mt. Pleasant.....	Dr. Max E. Witte.
College Springs.....	Prof. H. K. Holcomb.	Neola.....	J. H. Garland, Jr.
Corning.....	John W. Bixby.	New Hampton.....	O. L. Gabrilson.
Council Bluffs.....	J. B. Rishel.	Newton.....	A. Lufkin.
Cresco.....	Gregory Marshall.	Northwood.....	A. L. Thompson.
Davenport.....	*F. J. Walz.	Odebolt.....	E. Starner.
Delaware.....	Wm. Ball.	Ogden.....	E. Sayre.
Decorah.....	F. H. Baker.	Omaha, Neb.....	*L. A. Welch.
Denison.....	Wm. A. McHenry.	Osceola.....	A. W. Lewis.
Des Moines.....	*Geo. M. Chappel, M. D.	Ovid.....	H. C. Miller.
Dows.....	R. E. Fuller.	Osage.....	G. D. Patingill.
Dubuque.....	*L. M. Tarr.	Oskaloosa.....	Jos. Boyd.
Eldora.....	Prof. O. F. Woodward.	Ottumwa.....	L. J. Baker.
Elkader.....	Chas. Reinecke.	Plover.....	J. S. Smith.
Estherville.....	M. L. Archer.	Portsmouth.....	J. W. Dahlheimer.
Fairfield.....	Charles J. Fulton.	Primghar.....	E. S. Proper.
Fayette.....	R. Z. Latimer.	Red Oak.....	Geo. W. Holt.
Ft. Madison.....	Miss L. A. McCready.	Reinbeck.....	Dr. L. B. Hathaway.
Fonda.....	Chas. F. Linnan.	Rock Rapids.....	W. O. Wyckoff.
Forest City.....	J. A. Peters.	Rockwell City.....	Prof. G. B. Rigg.
Fredericksburg.....	C. E. Wright.	St. Charles.....	R. D. Minard.
Galva.....	W. A. Crowley.	Scranton.....	N. O. Nelson.
Garden Grove.....	M. Wemple.	Seymour.....	Mrs. C. A. Conger.
Gladbrook.....	Geo. F. Parker.	Sibley.....	H. G. Doolittle.
Glenwood.....	J. P. Jackson.	Sidney.....	G. V. Swearingen.
Grand Meadow,		Sigourney.....	Prof. E. H. Griffin.
(Postville).....	F. L. Williams.	Sioux City.....	*U. G. Pursell.
Greene.....	J. L. Cole.	Sac City.....	Dr. C. Brown.
Greenfield.....	J. G. Oulver.	Spencer.....	S. Gillespie.
Grinnell.....	Prof. S. J. Buck.	Spirit Lake.....	W. O. Drummond.
Grundy Center.....	Geo. F. Ellis.	Stuart.....	J. C. Pugh.
Guthrie Center.....	W. T. Anderson.	Toledo.....	Chas. Mason.
Hampton.....	E. C. Grenelle.	Vinton.....	T. F. McCune.
Hawkeye.....	Miss I. Whorley.	Villisca.....	H. C. Stoddard.
Hopeville.....	M. T. Ashley.	Washington.....	Wm. A. Cook.
Humboldt.....	H. S. Wells.	Waterloo.....	M. L. Newton.
Independence.....	E. F. Wulke.	Waverly.....	H. S. Hoover.
Indianola.....	Prof. J. L. Tilton.	Waukegan.....	N. C. Wragg.
Iowa City.....	Prof. A. A. Veblen.	Webster City.....	Louis Frank.
Iowa City.....	Mrs. C. M. Hobby.	Wilton Junction.....	J. M. Rider.
Iowa Falls.....	J. B. Parmelee.	Winterset.....	W. W. McKnight.
Keokuk.....	*Fred. Z. Gosewisch.	West Bend.....	Phil. Dorweiler.

* U. S. Weather Bureau.

WEATHER CROP OBSERVERS.

STATIONS.	OBSERVERS.	STATIONS.	OBSERVERS.
Agency.....	J. H. Van Zant.	Le Mars.....	Hon. Henry Schrooten.
Albia.....	Wm. Mercer.	Lawler.....	Hon. Wm. Glattly.
Alta.....	Jonas Cushman.	Lockridge.....	John F. Farman.
Ames.....	C. D. Reed.	Marshalltown.....	Hon. S. B. Packard.
Atwood.....	J. H. Tanner.	Mason City.....	Wm. Nettleton.
Battle Creek.....	A. Preston.	Mapleton.....	A. Lamb.
Boone.....	L. C. Morris.	Mt. Pleasant.....	W. S. Wright.
Bristow.....	G. W. Wells.	Milton.....	Hon. E. C. Holland.
Centerville.....	Henry Galley.	Mount Vernon.....	Robert Smith.
Charles City.....	W. B. Townner.	North English.....	J. L. Williams.
Chariton.....	C. O. Burr.	Nevada.....	Geo. C. White.
Clarksburg.....	F. M. Russell.	Osage.....	E. W. Stacy.
Correctionville.....	Hon. W. B. Chapman.	Orange City.....	H. J. VandeWaa.
Corning.....	Jerome Smith.	Paton.....	A. B. Condit.
Clermont.....	Chas. Larrabee.	Pittsburg.....	G. C. Duffield.
Council Bluffs.....	L. Prouty.	Rock Rapids.....	D. E. F. Merrill.
Creston.....	M. V. Ashby.	Rockwell City.....	J. G. Palmer.
Danville.....	Sherman Matthews.	Rossville.....	T. B. Wiley.
Emerson.....	D. B. Nims.	Ruthven.....	F. W. Teed.
Ely.....	Hon. A. J. Fuhrmeister.	Sageville.....	Hon. F. N. Knoll.
Fulton.....	Carl S. Frank.	Seymour.....	L. B. Sager.
Fontanelle.....	Hon. L. M. Kilburn.	Shenandoah.....	Reuben Mullison.
Ford.....	J. O. Richards.	South Amana.....	John Cownie.
Fort Dodge.....	R. W. Blaine.	State Center.....	E. P. Thompson.
Geneva.....	Wm. H. Thompson.	Sumner.....	John Dawson.
Grinnell.....	A. O. Price.	Tama.....	W. G. Malin.
Guthrie Center.....	W. W. Bailey.	Unity.....	Edw. Hammer.
Hesper.....	G. E. Dillingham.	Van Horne.....	Spencer Smith.
Hodge.....	James Piper.	Washita.....	H. L. Felter.
Humeston.....	Hon. S. H. Moore.	Willow Creek.....	W. S. Nicholson.
Independence.....	C. L. Thomas.	Winterset.....	H. A. Kinsman.
Indianola.....	T. B. Hammer.	Wall Lake.....	T. E. Wilcox.
Jefferson.....	S. M. Taylor.	Wilton.....	Thos. Boot.
Knoxville.....	G. W. Mendenhall.	West Union.....	J. W. Bopp.
Larrabee.....	H. H. Carnahan.		

METEOROLOGICAL SUMMARY FOR 1896.

Atmospheric Pressure.—Mean atmospheric pressure for the year, 30.05 inches. The highest pressure recorded at any station was 30.90 inches, on January 3d, at Clarinda and Omaha; and at Cresco November 30th. The lowest observed was 29.12 inches, on March 28th, at Sioux City. The range for the state was 1.78 inches.

Temperature.—The mean temperature for the year was 48.5°, which is about 2° above the annual average. The highest mean reported was 53°, at Keokuk, and the lowest 41.2°, at Sioux City. The maximum temperature reported was 104°, at Malvern, Estherville and Madrid, on July 3d, and the same extreme at same places August 7th. The minimum for the year was 20° below zero, on January 4th, at Cresco. The range for the state was 124°.

Precipitation.—Average for the year, 37.45 inches, 2.57 inches above the state normal. The highest total recorded was 51.60 inches, at Waterloo. Davenport and Primghar reported the lowest amount—28.68 inches.

Wind and Weather.—Prevailing direction of wind, northwest; highest velocity, 60 miles an hour, at Davenport, May 16th. Average daily wind movement, 191 miles. There were 145 clear, 105 cloudy and 161 partly cloudy days. Rain fell at some point in the state on 86 days.

RELATIVE HUMIDITY.

For the purpose of study and comparison we give below some figures showing the mean relative humidity of the air at the central station at

Des Moines for the six crop months (April 1st to October 1st) in the years 1894 and 1896. The season of 1894 was phenomenally dry, especially during the crop growing months of May, June, July and August. The season of 1896 was unusually wet, with more than normal amount of cloudiness. The following table gives the mean monthly humidity for the two seasons, expressed in percentages:

MONTHS.	1894.	1896.
April.....	81.7	62.6
May.....	54.6	60.1
June.....	54.6	66.9
July.....	45.8	69.5
August.....	55.8	72.6
September.....	69.1	78.8
Mean.....	57.3	69.5

Here we note a difference of 13 per cent in the mean relative humidity of these two seasons. For the four crop months, May to August, the mean in 1894 was 52.7 per cent, and in 1896 it was 69.5 per cent, a difference of about 17 per cent. During the month of July, 1894, the humidity measured only 45 per cent, and there were many days when the evening observations showed from 15 to 30 per cent of relative humidity. In July, 1896, the average was about 70 per cent, and there were some days when the maximum reached very near to the point of saturation.

In 1894 the air was so dry that the dew point was very near the line of freezing temperature, while in 1896 the percentage of humidity was so high that rainfall resulted from a slight fall of the temperature.

The year 1896 is notable from the fact that the fall months were excessively damp, cloudy and cool. It was a year without an Indian summer, which is a rare occurrence in this region.

MONTHLY SUMMARIES FOR 1896.

JANUARY.

The month was usually mild and pleasant. The mean temperature for the state was 23.4°, which is 7° above the January normal. The coldest period was from the 1st to the 5th, and the lowest recorded temperature in the state was 20° below zero, at Cresco, on the 4th.

The average precipitation was .48 of an inch—.9 of an inch below normal. The least amount reported was a trace, at Denison and Rock Rapids; the greatest amount 2.10 inches, at Seymour.

There were 10 clear days, 11 cloudy, and 10 partly cloudy. The highest atmospheric pressure of the year, 30.60 inches, occurred on the 3d, at Clarinda and Omaha.

FEBRUARY.

The month was unusually warm and pleasant, and notably free from violent storms and the extremes incident to midwinter in this midland region.

The monthly mean temperature for the state, as reported by ninety-two observers, was 27.4°, which is about 5° above the February normal. The highest reported was 78°, at Glenwood and Omaha, on the 26th; lowest, 13° below zero, at Cresco, on the 20th, and Wilton, on the 17th. During the past twenty-five years there have been six warmer Februaries.

The average precipitation was .71 of an inch. Ottumwa reported the largest amount, 2.40 inches; least amount, .04 of an inch, at Spencer. There were 12 clear days, and more than the average amount of sunshine.

OBSERVERS' NOTES.

Donipate—HON. B. E. VALE: The winter's frost practically out of the ground. A mild, pleasant and profitable month.

Chariton—HON. S. H. MALLORY: Roads have been good all the month except the last week.

Charlottesville—A. S. VAN SANDT: A warm, dry month. A good deal of ground plowed during the last week.

Clinton—DR. LUKE ROBERTS: Thirteen days of fair sleighing during the month. The windstorm of the 18th amounted to a blizzard, as the snow lying on the ground was lifted and drifted about most fantastically, and it was accompanied by a liberal supply of sand and dirt which the 30-mile wind had gathered.

Elkhart—CHARLES REINCKE: Ice broke and went out in Turkey river on the 25th.

Emmettsburg—J. H. CARMICHAEL: Dust and sandstorm on the 18th; geese and ducks flying north on the 14th; meadow larks seen on the 25th.

MARCH.

The month of March was cool and dry. The mean temperature for the state was 30.9°, which is about 1° below the normal. The highest temperature reported was 51°, at Belknap, on the 30th; lowest, 12° below zero, at Rock Rapids, on the 13th.

The average precipitation, as shown by reports from ninety-nine stations, was 1.10 inches, which is .97 of an inch below normal. Sidney reports the largest amount, 3.99 inches, least amount, .16 of an inch, at Keosauqua.

The worst storms of the month were duststorms, which were quite severe in many localities. There were 12 clear days, 10 cloudy and 9 partly cloudy.

OBSERVERS' NOTES.

Belle Plaine—S. P. VANDIKE: Duststorm on 31st, continuing all day, restricting the range of vision to a few rods.

Donipate—HON. B. E. VALE: A dry, windy month. Farm work began on 25d. Soil very dry. Only about one-fourth the usual rainfall for the month.

Charles City—J. W. SMITH: A great amount of dust in the air, on windy days, from the 18th to the 26th. On the 21st the sun was almost obscured by the dust. On the 30th was another dark day, followed by rain and thunderstorm.

Corning—J. W. RINNEY: Heavy thunderstorm on evening of the 27th, the first of the year. Thermometer fell 40° in six hours on the 21st.

Dones—R. E. FULLER: Very high wind, with clouds of dust, on the 21st. First thunderstorm of the year on the 27th, with hail; another of the same sort on the 31st.

Clinton—DR. LUKE ROBERTS: March, 1896, did not depart materially from the characteristics of the first spring month. Most of the conditions were near normal.

The mean temperature of the month was 32.4°; the highest temperature, 69°, date 31st; lowest temperature, 5° above zero, date 13th; coldest day, 13.7°, date 19th; rainfall, 95 of an inch; number of storm days, 7; number of cloudy days, 9; number of clear days, 11; per cent of cloudiness, 46; prevailing direction of wind, northwest; maximum velocity, 22 miles an hour, date 21st; total movement of wind, 5,500 miles. The greatest March movement of wind during the last fifteen years was 5,330 miles, occurring in 1882.

APRIL.

The noteworthy features of the month of April were abnormally high temperature and excessive rainfall—a combination rarely experienced so early in the season. The mean temperature for the state was 54.5°, which is 6.5° above the normal. The first decade was unseasonably cold, the records of the central station showing an accumulated deficiency of 51° (below normal) on the 9th; but at the close of the month there was an excess of 166°, an average daily excess of 5.5° for the full month. The last freeze was noted on the morning of the 10th, after which date there were no killing frosts observed in the state. It was the warmest April, on the average, ever known in this state since the stations of observation have been established; and it was also one of the wettest Aprils on record.

The average precipitation for the state was 5.03 inches, which amount is 2.45 inches above the April normal in Iowa. The distribution was more nearly equal than usual, all parts of the state receiving ample moisture to serve the present needs of vegetation. The highest amount reported was 9.07 inches at Cedar Falls, and the lowest, 2.35 inches at Keokuk. Distributed by districts the averages were about as follows: Northeast district, 6.04; North Central, 6.01; Northwest, 5.78; West Central, 6.30; Central, 5.30; East Central, 5.70; Southeast, 4.10; South Central, 3.40, and Southwest, 3.45 inches. A considerable portion of the precipitation that fell in the first decade was in the form of snow, sleet and hail.

The high temperature and frequent showers of the second and third decades of the month pushed vegetation forward at an unusual pace, and at the close the season was rated as ten days earlier than the average of recent years. It was a notably favorable month for farm work and growth of crops.

OBSERVERS' NOTES.

Alta—DAVID E. HADDEN: On April 7th, from 5 to 7 o'clock P. M., a very heavy thunderstorm, accompanied by high wind, hail, sleet and snow, and followed by heavy rain, prevailed. Hail and sleet drifted from six to eight inches deep in places. Lightning was intensely vivid and sharp, and struck several telephone poles near town; the storm was a phenomenal one for the time of year. Another heavy rain, with sleet, occurred on the 8th, from 3 to 7 o'clock P. M.

Clinton—DR. LUKE ROBERTS: My memory does not recall an April during the last two decades in which so many meteorological conditions seemed more happily combined and seasonable, than those credited to April, 1896.

The mean temperature was 56.5°, or 7.4° above normal. Not only this, but it was the warmest April in eighteen years by 3.3°. April, 1881, was the coldest April, recording a mean of 43.7°, giving a range of temperature of 13.8°.

The cold period of the month was from the 1st to the 10th; the last freeze occurring on the latter date. After this, on the 25d, there was one light frost.

Total precipitation for the month was 4.33 inches. This is 1.33 inches above normal. There was thunder and lightning on seven different days, but mostly mild—no damage reported.

Bonaparte—HON. B. R. VALE: A seasonable month, very like that of 1895, only warmer. Rainfall for March and April this year exceeds same period last year by .08 of an inch—nothing to brag on.

Corning—J. W. BERRY: There were eight thunderstorms during April, but none of much severity. Fine growing weather.

Grand Meadow, Clayton County—F. L. WILLIAMS: Rainfall, 6.35 inches—the heaviest for any April in fifty years. In 1836 the amount was 5 inches. Springs and wells beginning to run.

Grundy Center—GEO. F. ELLIS: Good feed in pastures April 10th. *Humboldt*—H. S. WELLS: This season beats last year in every way. Fruit in full bloom. Work well along.

Iowa Falls—J. B. PARMELEE: Sixth, sowing wheat; 13th, seeding begins in earnest; 16th, making garden; 20th, plowing for corn begun; 27th, plum blossoms; 28th, apple blossoms.

MAY.

The month was characterized by the prevalence of low atmospheric pressure, high temperature, excessive rainfall and severe local windstorms.

The mean temperature for the state, as deduced from ninety-nine stations, was 65.5°, which is 5.5° above normal. It was the warmest May since 1881, according to the records of the United States Weather Bureau stations within the state.

The average rainfall for the state, as shown from records of 107 stations, was 6.69 inches—2.54 inches above normal. The highest measurement was reported from Mt. Ayr—11.79 inches. All parts of the state suffered to some extent from excess of moisture. The bulk of the rainfall came in the second decade of the month.

OBSERVERS' NOTES.

Ammono—C. SCHADT: During the thunderstorm on the 21d, 1.70 inches of rain fell in twenty minutes, and 1.94 inches in fifty-five minutes.

Bonaparte—HON. B. R. VALE: Exceedingly wet since the 12th; 7.54 inches of rain, the greatest monthly precipitation for five years. No farm work done since the 12th.

Telepho—CHARLES MASON: The total precipitation for the two months,

April and May, is 11.08 inches, and for the year up to the present time is 12.62 inches. The general outlook for crops is splendid.

ONAWA—C. G. PERKINS: Following are the records of precipitation at Onawa from January 1st to June 1st, 1896: January, .30; February, .28; March, 1.34; April, 6.18; May, 7.34. Total for the five months, 15.44 inches. The average for this period in the last seventeen years is 11.34 inches.

MAY'S DESTRUCTIVE STORMS.
[From Monthly Review, May, 1896.]

The meteorological pendulum, in swinging from the extreme of drouth to the opposite extreme of excessive rainfall, brought the usual accompaniment of elemental disturbances. The reaction, as was to be expected, caused numerous violent local storms, involving sad losses of life and property.

This great interior valley is irrigated by cyclonic storms which must needs be produced by a vast expenditure of nature's energies. These cyclones are as essential as sunshine to the life, health and prosperity of this region, and though the gigantic forces employed in the production of cyclonic movements sometimes cause violent action of the elements, yet the good resulting therefrom immeasurably exceeds the incidental ill.

The month of May, 1896, has been made historic by its unusual number of violent local storms, involving considerable loss of life and destruction of property amounting to millions of dollars. These more violent disturbances have occurred within a wide belt extending from near the Gulf of Mexico to Lake Huron, involving portions of Texas, Oklahoma, Kansas, Nebraska, Missouri, Iowa, Illinois and Michigan, with considerable excess of force in a number of states eastward of this belt. Iowa has suffered quite severely, though the life and property losses have been much less than in a number of other states.

THE STORM OF MAY 24TH.

The most disastrous windstorm of the month in this state occurred on the night of Sunday, May 24, and the worst effects were produced in Polk, Jasper, Delaware and Clayton counties.

That day was one long to be remembered by those who took note of the meteorological conditions. The remark was frequently heard, "This is a genuine cyclone breeder." The wind was southerly, the temperature of the day being considerably above normal, with a high percentage of humidity and increasing cloudiness.

The weather map on the morning of the 24th showed a "low," or cyclone, advancing from the northwest. The evening map indicated that the low had advanced rapidly during the day, and was then central in South Dakota, Iowa being in the southeast quadrant of the depressed area.

At the Des Moines station the air seemed unusually oppressive, with high "sensible temperature," and with the approach of nightfall the western heavens became murky with advancing storm clouds. At about 9 P. M. a very heavy and threatening bank of cloud appeared in the northwest, coming rapidly toward the southeast, apparently moving directly toward this city. The flashes of lightning were vivid and almost incessant, and, as the cloud approached, the sound of thunder was continuous,

varied only by frequent loader crashes and crackling of the electric fluid. Seeds of clouds and some heavy masses of cumulus were observed moving with unusual rapidity from the south and southwest toward the vortex of the coming storm. In fact, the visible masses of vapor from all points appeared to be drawn irresistibly to the center of the storm, as puffs of smoke are drawn toward the funnel of a chimney.

An apparent change was then noted in the direction of the storm, its course being deflected toward the east and northeast. The central shaft of disturbance passed within six miles of the northern limit of Des Moines, and its swiftness of movement was noted when it reached a point directly north of the city. The characteristic roar of the tornado was heard by hundreds of observers who closely watched the awful spectacle. The sound was easily distinguished from the frequent peals and crashes of thunder, being continuous and resembling the noise of heavy trains on a distant railway. Those who noted the passing of that storm and heard its peculiar roar were strongly impressed by the belief that the next morning would bring news of disastrous effects along its pathway from west to east; and the result more than justified their fears.

The character of the storm was made evident by observations at points where the greatest destruction was wrought. The people who resided in or near its pathway say that heavy rain and sharp lightning preceded the windstorm, which lasted but a few moments.

The records of the insurance offices of this city, wherein losses by wind are covered, show that the storm began its work of destruction southwest of Woodward. The first complete loss occurred in section 31, Des Moines township, Dallas county, where the barn and residence of a Mr. Gill were swept away, happily without loss of life. At this point a schoolhouse was whirled away, leaving the floor, and not a timber of the house has been discovered. In section 34 of the same township, the buildings of Mr. William Nixon were damaged. The storm passed north of Granger, causing damage at various points. In section 4, Jefferson township, Polk county, Mr. Heckman's buildings were destroyed and a fine grove of trees ruined—"twisted into matches"—but no one injured. At that place, Mr. Heckman says, the storm cloud deflected southward a mile or two, then crossed the river and went eastward toward Ankeny, Bondurant and Valeria. A number of losses were suffered near Ankeny, in Crocker township; also in Douglas and Franklin townships, Jasper county, striking the storm then passed into Poweshiek township, Jasper county, striking Valeria in its course, and going thence north of east to a point near Baxter, where its destructive force abated. From the point of inception to its ending the track forms a slightly curved line, or change of course from southeast toward the northeast. The width of the main track was from about 1,000 to 2,000 feet. Outside of this track some destructive effects were produced by lateral currents, or side winds flowing towards the central shaft or funnel. There are some indications of the action of several minor tornadoes within the belt covered by the storm. Losses have been reported in Madison township, several miles from the main track.

A visit to Bondurant and Valeria, by the director and assistant director of this service, gave sufficient evidence as to the character of the storm. The characteristic effects of tornadoic force were noted at a number of points, notably at the Bailey farm, near Bondurant, at Valeria and in the

timbered tract along the Great Western railway east of the latter place. On the south side of the central track trees and wreckage of buildings pointed toward the northeast; north of the center the debris was strewn towards the southwest. The uplifting power of the storm were shown in the uprooting of trees and tossing them bodily, roots, trunks and branches, over the railway embankment. The writer saw one instance of that kind, the tree measuring 18 inches in diameter at the butt and well proportioned in height. Scores of very heavy trees were first uprooted and then dragged bodily, tops foremost, from five to ten rods. The destruction of the railway bridge beyond Valeria was a marvellous exhibition of the uplifting force of the storm at the center of its track.

Luckily there was no town on the direct line of the storm, though it narrowly missed Bondurant and grazed Valeria closely. If either place had been right in its path, no habitation or other building would have survived the shock. The entire length of the pathway of destruction was nearly forty miles, though at numerous points on the line but slight effects are visible.

The destruction of property will probably aggregate from \$70,000 to \$80,000; but worst of all is the loss of human lives, and the terrible suffering endured by the bruised and mangled survivors. The total number of deaths is reported to be twenty people, of various ages.

The time occupied in passing over the forty miles of its track was about an hour and twenty minutes, as nearly as we can estimate from the various reports. It is said that the clocks which were stopped near Valeria, point to the hour of 10:40. At Bondurant the residents say the storm struck there at 10:30. It certainly began its operation at the extreme western end of the line as early as 9:20 P. M.

STORMS AT OTHER POINTS.

On the same night (May 24th) severe wind squalls occurred at various points in Delaware and Dubuque counties, followed by heavy downpours, causing destructive floods.

Near Manchester numerous buildings were leveled by the hurricane, and at Dyersville and New Vienna extensive damage was caused by floods.

A cloudburst caused a very damaging flood between North McGregor and Beulah, and newspaper reports state that three whole families were swept away with a loss of eighteen lives. The entire valley between those two points was swept nearly clean of bridges and buildings. Numerous freight cars were swept from the tracks of the Chicago, Milwaukee & St. Paul road and several thousand feet of railway track carried away.

The floods were also damaging at Dubuque, and at Darango, six miles west of Dubuque, the railway station was swept away and five persons were drowned. It was a night of fearful storms, attended by loss of life and property, in Iowa, Illinois and other western states.

JUNE.

The month of June was notably genial and favorable to all forms of life. The mean temperature for the state was 69.1°, which is the normal for the month. There were but few oppressively warm days, and these were followed by nights of refreshing coolness.

The average precipitation, as shown by the records of 105 stations, was 3.11 inches. The distribution was quite unequal, the largest amount reported being 7.89 inches at Atlantic, and the least .81 of an inch at Vinton. The rainfall was 1.45 inches below the June normal, but the ample supply of water stored in the soil in April and May prevented any injury to crops by the shortage in this month.

OBSERVERS' NOTES.

Amana—C. SCHAFF: Harvesting rye began on the 22d.

Atlantic—J. W. LOVIE: Hail stones larger than hens' eggs fell for several minutes on the 5th.

Atlantic (near)—GEO. W. FRANKLIN: High wind from northwest at 11:30 P. M., 24th. Windmills, small buildings, etc., were destroyed.

Bonaparte—HOS. B. R. VALE: A seasonable month and no heavy rains or storms, but a uniformly low barometer from May 10th to the close of June without much variation.

Clinton—DR. LUKK ROBERTS: June, 1896, was a very fine month. The growth and development of all products of the farm have been almost phenomenal. The same can be said of garden truck and most kinds of fruit. The apple crop seems not as great as in some years. Berries and grapes are abundant—the former of excellent quality and the latter promise to be. The vines seem much more vigorous and hearty than for several years.

JULY.

The mean temperature of July, shown by reports from 103 meteorological stations, was 73.6°, which is 3° below normal. The highest temperature reported was 104°, at Malvern, on the 3d; lowest, 43°, at Elkader and Mason City, on the 9th and 16th.

The average rainfall for the state, as reported from 105 stations, was 6.90 inches, which is 2.60 inches above the normal. The bulk of this large amount of rainfall came in the last half of the month, causing much delay in completing harvesting and considerable damage to grain in shock and stack. The largest amount reported was 12.67 inches, at Moor, and the least amount, 1.61 inches, at Rock Rapids. It was an unusually wet July, especially unfavorable for harvesting and threshing small grain. Heavy showers with severe wind squalls were frequent in the latter part of the month.

OBSERVERS' NOTES.

Alta—DAVID E. HADORN: A destructive hail and windstorm passed through the north central part of Buena Vista county Sunday evening, the 26th, about 7 o'clock. The day had been peculiarly warm and oppressive, and during the afternoon a storm formed in the south. It passed over town in the shape of a gentle and refreshing shower. About half past 5 another storm formed in the northwest, the clouds being of a deep blue color. It swept along the northern horizon and disappeared to the northeast. Monday morning the news of a terrible hailstorm reached town. It entered the county on the west lines of Elk and Brooke townships, and was four miles in width. Crops were devastated, poultry and young stock killed or drowned, windows and roofs smashed by the falling hail. With possible exceptions, the crops on the four tiers of sections are

entirely destroyed. The storm continued through Scott and Lincoln townships with terrible destruction to everything in the shape of vegetation. It is estimated the damage in this county will reach the neighborhood of \$60,000. A number of the farmers affected by the storm carried insurance on their crop and stock. The Farmers Mutual of Buena Vista county is interested in several instances. It is very hard on some of the farmers who have been working all summer, and who see their work and expenditures come to naught in a few minutes.

In Cherokee and Plymouth counties the storm did a vast amount of damage, these counties being hit as hard as Buena Vista.

Plover—J. S. SMITH: Sunday night, the 26th, heavy north wind blew corn down quite bad. Eight miles south the wind did considerable damage to corn. There was also considerable damage done by hail during the storm.

Portsmouth—J. W. DAHLKEIMER: On the 26th, terrific windstorm accompanied with thunder and rain.

Primghar—E. S. PROPER: Terrible windstorm on the evening of the 2d. Considerable damage done; barns, etc., blown down.

Sidney—G. V. SWEARINGEN: An electric storm on the night of the 27th. No damage done. Lightning almost continuous for about four hours; a few heavy peals of thunder. Considerable wind, which downed corn badly in many places; also upset and unroofed a number of corn cribs and outbuildings on the west of Nishna.

Le Mars—DR. T. E. COLE: A thunderstorm on the 26th was light in this city, but in northern, eastern and western parts of county was accompanied by heavy hail, doing a great amount of damage, laying small grain and corn, and killing poultry and hogs.

AUGUST.

The mean temperature for August was 71.7°, which is .7° above the normal for this month. The first half of the month brought the highest temperature of the season, the protracted heated term being phenomenally severe on account of the excessive humidity. The excess of temperature at the central station for the first fifteen days of the month was 64°, or more than 4° daily. The mean relative humidity for that period was 76 per cent. The last half of the month was cooler than the seasonal average, bringing the mean temperature of the month down to about the normal.

The average precipitation for the state was 3.22 inches, which is about the normal amount for August. The distribution was quite unequal, the northern districts receiving less than other sections. The highest amount reported was 12.25 inches, at Centerville, and the least quantity .86 of an inch, at Sioux City. Thunder and hailstorms of unusual severity occurred in numerous localities.

OBSERVERS' NOTES.

Afton—HON. N. W. ROWELL: Rivers and creeks all out on bottoms on the 14th; highest since July 5, 1888.

Bonaparte—HON. B. R. VALE: A poor month for saving the grain crop; vegetation, weeds and grass unprecedented. Closed favorable for maturing the corn crop.

Corning—JOHN W. BIRBY: Hot wind from the southwest on the 11th, which scorched leaves on the trees.

Etherville—M. L. ARCHER: On the 12th, severe electric storm with high wind, blowing down rail buildings and outbuildings. Grain stacks and corn blown down.

Grand Meadow—F. M. WILLIAMS: August 15th, a heavy thunderstorm, with wind and a little hail, did great damage to windmills, trees and grain stacks; also blew corn down badly. A peculiarity of the month was the bright days and bracing nights.

Northwood—A. L. THOMPSON: Excessive heat for this section 3d to 10th, inclusive.

Osht—H. C. MILLER: Heavy thunderstorms on the 5th, 14th and 15th, with much destruction to property by lightning; six horses killed, more than twenty head of cattle and four barns destroyed. Several other buildings struck, some stacks damaged. Many meteors seen the nights of the 3d and 14th.

Spencer—F. E. WILLARD: Severe thunderstorms on the 14th and 15th. On the 15th lightning struck the German Lutheran church, setting fire to the roof and damaging the church about \$100.

Toledo—CHAS. MASON: About three inches of rain fell this month, accompanied by a great amount of electricity, doing much damage in striking and burning buildings, and killing, etc. No mention is made of any rodged buildings being struck, in the reports.

SEPTEMBER.

The month of September was unseasonably cold and wet, with less than the average amount of sunshine. The mean temperature for the state was 55.5°—2.5° below the September normal. The highest temperature reported was 85° at Bonaparte on the 3d, and at Malvern on the 8th; lowest temperature reported, 32° on the 27th at Mason City. Severe and killing frosts occurred on several days in the last decade of the month.

The average precipitation was 1.09 inches—19 of an inch above normal. The distribution was quite unequal, ranging from 9.96 inches at Moor to 1.83 inches at Iowa City.

It was an unfavorable month for ripening belated corn, and the early frost caught some of it in a premature stage.

OBSERVERS' NOTES.

Afton—HON. N. W. ROWELL: Night of the 19th, first frost. No damage to vegetation. Twentieth, corn blades frosted; corn not hurt.

Atta—PROF. D. E. HADDEN: First killing frost of the season on morning of 19th.

Bonaparte—HON. B. R. VALE: A very dismal month. Vegetation kept green, and but little fall work accomplished.

Clinton—DR. LUKY ROBERTS: September, 1886, opened with three clear days, then two partly cloudy days, followed by two more clear days. The principal clear days during the balance of the month were the 19th to the 23d, both inclusive. The 19th and 20th were cold, the first frost of the season coming on the morning of the latter date. This was a killing frost, the temperature of the air dropping to 31°. Quite a heavy frost also

came on the 23d, with minimum temperature 33°. On the 28th a lighter frost occurred. No other frost during the month. The earliest autumnal frost during the last eighteen years was on the 8th of September, 1880, but was light.

Cresco—GREGORY MARSHALL: First killing frost occurred on the 20th. Ice formed.

Grand Meadow—F. M. WILLIAMS: The month has been cloudy and wet; corn all ripened before the frost came. Threshing is very slow with a good deal of wet grain. Fall feed is fine; spring seeding a good outlook.

Lorrabee—H. B. STREYER: Vegetation killed by frost on the 19th.

Logan—MRS. M. B. STERN: The month has been rather cool; an unusual number of frosty mornings for September, and yet, away from the bottom lands, things are not badly killed.

Sac City—DR. CALED BROWN: Light frost morning of 19th. Corn and tender vegetation bitten.

OCTOBER.

The month of October gave an average amount of clear and pleasant weather, although there was a slight excess of rainfall, which occurred during the periods as follows: from the 1st to the 8th, light and scattered showers occurred. Heavy and general rains occurred from the 9th to the 11th and from the 27th to the 30th, the remainder of the month being clear with about the normal October temperature. The average amount of rainfall was 3.13 inches—.28 of an inch above normal, and with few exceptions, was well distributed.

The average temperature for the state was 47.0°—1.6° below normal for the month. As there was but an average of 5 days on which .01 inch or more of precipitation fell, and 18 clear, and 6 partly cloudy days, it will be seen that the weather was favorable for fall plowing and harvesting of corn.

NOVEMBER.

The month was characterized by sharp reactions and wide ranges of temperature. The mean temperature for the state was 29.6°, which is 4.5° below the normal for November. Wintry weather prevailed for the most part during the last half of the month, with heavy snows in the northern districts of the state. Spirit Lake reported the lowest monthly mean, 19.3°, which is below the December normal.

The average range of temperature was 73.1°. The lowest temperature reported was 15° below zero at Rock Rapids on the 30th. Highest temperature, 83° at Belknap on the 16th.

The average precipitation (rain and melted snow) was 1.53 inches—.07 of an inch above normal. The largest amount reported was 4.51 inches at Spencer; least amount, .16 at Atlantic.

DECEMBER.

The month of December was unseasonably warm, the daily mean temperature for the state being 30.8°, which is 7° above the normal. The daily mean was 1.3° above the temperature of November. There have been few

warmer Decembers within the past twenty-five years. It was, in fact, too warm and murky at times for the best condition of public health.

The average precipitation was .65 of an inch—1 inch below the normal amount for December. There was no snow within the limits of the state at the close of the month.

OBSERVERS' NOTES.

Ames—CONRAD SCHAFF: Plowing went on the greater part of the month. At the close of the year the ground was free from frost and the river and creeks free from ice.

Bonaparte—HON. B. R. VALE: A rare December for all kinds of outdoor labor and for feeding stock. Cattle and horses have done well on meadows and pastures all fall.

Decorah—WILLIAM BAILL: The month has been remarkable for high temperature, lack of sunshine and foggy weather.

Grand Meadow—F. L. WILLIAMS: The month was abnormally warm; ground bare most of the time and the roads either muddy or very rough. On the 11th the frost was nearly all out of the ground and the surface very wet.

Hopewille—M. T. ASHLEY: Total precipitation for 1896, 41.41 inches. Does anyone think Iowa is drying up?

Levas—J. L. HURLEY: Ice out of ponds since the 28th. Thickness of ice for the month, 2 inches.

Ovid—H. C. MILLER: A warm rain on the 31st. Frost all out of the ground and grass growing. No ice on the ponds and streams. A very warm month, with an unusual number of foggy days and but light rains and snowfall.

Carroll—MOSES SIMON: December closed with a heavy rain, the frost nearly all out of the soil, and the roads in bad condition. Grass is turning green and it looks like spring.

THE WEATHER AT CLINTON.

DR. LUKE ROBERTS' ANNUAL REVIEW.

During the first five days of the year 1896 an unusual cold wave prevailed. This storm spread over the entire United States, except the extreme southern portion of the Florida peninsula. This cold wave was not marked for its extreme severity in Iowa, as in many other portions of the United States. The lowest temperature at Clinton during these five days was 10° below zero, and the maximum velocity of the wind was 22 miles an hour during a portion of the 3d.

The balance of the month was warm, but cloudy. The mean temperature for the month was 35.5°, being 5.7° above a January normal. Storm days were few and the precipitation light. A fine misty rain and a dense fog were the closing phenomena of the month. Moderate temperature continued till the 15th of February. On the 15th a windstorm of great severity came from the west, bringing with it clouds of sand and dirt

gathered from exposed fields, and mixed it with the snow which it lifted from the ground, and the combination moving at a speed of 30 miles an hour yielded no tranquillity of mind to those exposed thereto.

The cold period of the month is included in the 11th, 12th and 13th. Precipitation was light and drouthy conditions prevailed at the close of the month. The first storm following—a snowstorm—was precipitated on the 5th of April, while the temperature ranged from 32 to 36°. This coating of snow after so many stormless days, proved a great blessing, and nicely prepared the way for the numerous gentle showers which followed.

A washout storm visited this vicinity on the 28th, doing some damage. The month was unusually warm and showery, resulting in favorable conditions for the early development of grass and seeded fields.

May continued the flattering conditions for the growth and maturing of crops, so that from the 4th of April to the close of May there was a continued warmth in the air above normal; and, with frequent showers, vegetation made a rapid and continuous growth. The hot spell in this month was from the 5th to the 13th inclusive, and during that time the maximum temperature was above 90° for seven consecutive days. The weather continued favorable for growing crops throughout the month of June, the result being phenomenal. All products of the farm and garden, apples, berries, grapes, etc., gave promise of a large yield and of excellent quality. The three months ending on the 30th of June, 1896, were warmer than any corresponding period during the last eighteen years. This was due to the abnormal heat of April and May, June not having contributed to swell the excess of heat. Much thunder and lightning prevailed in June, doing some damage.

An excess of rain was the prominent phenomena of July. Other meteorological conditions did not depart materially from the July normal. The precipitation on the 18th, 21st and 23d was very heavy, especially that of the 21st, yielding 2.30 inches of water, the greater part of which fell in twenty minutes time. A little hail accompanied this storm, and the wind attained a velocity of thirty-two miles an hour. This storm was damaging to oats. Farther up the river, the water, in its violent descent through ravines, carried away much dirt and occasionally a bridge. The heavy rains caused a shrinkage in the hay crop, but in no way interfered with pasturage.

It was conceded that the value of the excess of precipitation and warm days and much sunshine had been of such incalculable benefit in Clinton county that any damage which resulted from excess of water was merely nominal. The soil was once more supplied with needed moisture, and springs and wells again yielded their customary flow of sparkling water. The fields became green and beautiful in their freshness, the trees and shrubs appeared smiling at the prospect of a renewal of life and brightened foliage, and the husbandman was happy in the prospect of an overflow in his granaries.

August gave propitious weather for farming interests, and the outlook at the close of the month was satisfactory. Unharvested crops, with the exception of potatoes, were exceptionally promising. Corn was then looked upon as a great crop; and, when harvest time came, later in the

season, the forecast was verified. Threshing was practically completed at the close of this month. Some marked phenomena, however, characterized the month of August. Extremes in temperature and the frightful play of electricity deserve some notice. From the 26th of July to the 12th of August the heat was great, and comfortable sleeping places were at a premium. With the exception of a few single days, no more excessive heat prevailed.

Wind, rain and electricity were the elements which brought fright to the people and destruction of their property on the 6th, 11th, 13th, 15th and 23d. The work of these players brought a harvest of damaged roads, prostrated crops, trees broken and uprooted, windmills demolished, skylights broken, awnings and signs carelessly handled, buildings demolished, barns, farm implements and grain burned, and cattle killed, besides some mischief by fooling with electric wires. These storms were not confined to the city, but embraced the country. September furnished an excess of rain and cloudiness, and a deficiency of heat and sunshine. These were the conditions which caused the slow maturity of the enormous corn crop, which had all along been so promising. Pastures at the close of the month were never better at the same date of season. A deficiency in warmth continued through October, but an excess of clear days and absence of precipitation did much to save the corn and harden it. A copious rainfall on the 29th was the principal storm of the month.

November and December were each deficient in rainfall, and each gave a temperature above normal, but the latter was more marked than the former. December's epilogue to the drama of 1896 was excessive foggy, and "his gloom grew upon him."

CONSPICUOUS.

Highest temperature, 97.5°, July 14th and August 8th.
Lowest temperature, 13° below zero, February 17th and 21st.
Extreme range of temperature, 109.5°.
Mean daily temperature, 49.4°.
Mean daily range of temperature, 21.6°.
Greatest mean monthly range of temperature, 23.4°, July.
Least mean monthly range of temperature, 18.5°, December.
Greatest daily range of temperature, 46°, March 30th.
Least daily range of temperature, 4°, December 6th.
Warmest month, July; mean temperature, 73.5°; 1.5° above that of 1895.

Cooldest month, January; mean temperature, 25.5°.
Warmest days, July 14th and August 4th; mean temperature, 84.7°; 4.2° above that of 1895.

Cooldest day, January 3d, 5.3° below zero.
Total number of days with maximum temperature 90° or above, 37; 8 in May, 7 of which were consecutive, from the 6th to the 12th inclusive; 7 in June, 14 in July and 8 in August.

Total number of days with the maximum temperature at 25° or below, 38; 9 in January, 9 in February, 5 in March, 7 in November, 8 in December.
Total number of days with the minimum temperature at or below 35°, 153; 30 in January, 27 in February, 36 in March, 9 in April, 1 in September, 10 in October, 23 in November and 27 in December.

Mean daily cloudiness, 46 per cent of the surface of the sky.

Months with the greatest per cent of cloudiness, January, 67, and December, 62.

Month with the least per cent of cloudiness, August, 33.

Total number of clear days, 142.

Total number of cloudy days, 110.

Month with the greatest number of clear days, August, 19.

Month with the least number of clear days, November, 7.

Month with the greatest number of cloudy days, January, 16.

Month with the least number of cloudy days, August, 3.

PRECIPITATION.

Total depth of snowfall, 27 inches.

Greatest fall of snow at any one storm, 9 inches, February 12th.

Total precipitation (rain and snow melted), 33.36 inches.

Greatest rainfall at any one storm, 2.30 inches, July 21st.

Month with the greatest precipitation, July, 7.13 inches.

Month with the least precipitation, November, 7.73 inch.

Month with the greatest number of storm days, September, 13.

Month with the least number of storm days, October, 2.

Total number of storm days, 96.

THE WIND.

Total movement of the wind, 42,100 miles.

Maximum velocity per hour, 32 miles in April, July and August.

Greatest monthly movement, 5,500 miles, in March.

Least monthly movement, 1,420 miles, in August.

Prevailing direction of the wind was from the west.

Observations taken at 7 A. M., 3 P. M. and 9 P. M., show the movement of the wind to have been from the north, 76 times; from the northeast, 143 times; from the east, 101 times; from the southeast, 101 times; from the south, 160 times; from the southwest, 173 times; from the west, 194 times; from the northwest, 150 times.

Maximum velocity for January, 34 miles an hour; for February, 30 miles; for March, 22 miles; for April, 32 miles; for May, 26 miles; for June, 20 miles; for July, 32 miles; for August, 32 miles; for September, 20 miles; for October, 16 miles; for November, 20 miles; for December, 22 miles.

SNOW AND FROST.

The last spring snow fell on the 8th day of April, 3 inches.

The first snow in autumn came on the 5th day of November. It was visible but not measurable.

The first snow to cover the ground made its arrival on the 2d of December and was about 1 inch deep. It disappeared the second day.

Last killing frost in the spring, April 10th. A light frost on the 23d.

First killing frost in autumn, September 20th.

Number of consecutive days without frost, 150; 13 more than in 1895.

The temperature of the air was at the freezing point or below for the last time in the spring, on the 10th day of April; 34 days earlier than in 1895.

The first in autumn, September 20th; 10 days earlier than in 1895.

The last day in spring when the mean temperature was below 35°, April 2d.

The first in autumn, October 24th.

ELECTRIC METEORS.

Number of auroras observed, 1.

Number of days with thunder and lightning, 35; being 4 above normal.

OPTICAL METEORS.

Number of solar halos observed, 1.

Number of lunar halos observed, 11.

Following is a table showing the yearly mean temperature, rainfall and movement of wind in miles for the years named:

YEARS.	Mean temperature in degrees.	Rainfall in inches and hundredths.	Wind movement in miles.
1879	45.9	32.96	42,100
1880	47.7	37.02	42,100
1881	47.6	41.18	42,100
1882	47.8	41.38	42,100
1883	48.0	39.71	42,100
1884	45.7	43.04	42,100
1885	45.8	38.71	42,100
1886	46.6	39.71	42,100
1887	47.1	34.61	42,100
1888	45.1	35.79	42,100
1889	45.1	39.19	42,100
1890	45.4	31.96	42,100
1891	45.9	33.97	42,100
1892	46.1	40.13	42,100
1893	46.2	39.59	42,100
1894	46.3	39.59	42,100
1895	47.2	39.29	42,100
1896	46.4	32.30	42,100
SUMS	845.4	532.52	772,333
Means	46.9	35.15	51,480

The above table shows the following facts: That the extreme range of the yearly mean temperature for the 18 years was 2°; that the greatest yearly mean was in 1894, and the least in 1885. That the total rainfall during 18 years was 52.73 feet. That the total number of miles the wind traveled during the last 15 years, at the speed it passed this city, was 772,333 miles, or an average of 990 miles per week, 6.30 miles an hour, and that the mean temperature for 1896 was 2.5° colder than an average of the last 18 years.

RIVER STATISTICS.

Furnished by Harry A. Walden, of the Chicago & Northwestern railroad: Ice started 7 A. M., March 20th, and at 10 o'clock the same morning the Mississippi river was practically clear of ice. The first boat to pass the bridge was the Chaney Lamb, going up at 4:25, March 26th.

The total number of boats which passed the bridge during the season

was 2,793—1,400 going up and 1,393 going down. There were also 370 barges and 828 rafts.

The river closed to navigation November 29th. November 28th, at 7 P. M., ice commenced to move, and blocked at 7:30 A. M., November 29th, but started again at 10:30 A. M., and ran until 8 A. M., November 30th, blocking solid. On December 9th the ice started again at 2:25 P. M., and stopped again after moving 100 feet, remaining closed until the 12th at 11:45 A. M., when a movement commenced, and after several days the river was free of ice. During this opening, the steamboat R. D. Kendall passed up at 7:35 A. M., December 30th. The river was clear of ice at the close of the year.

Water averaged low during the season, and was especially low during the months of January, February, March, April, August, September, October, and part of November and December. The lowest stage of water was 2 of a foot—March 20th. The highest was 13.5 feet, May 28th.

IOWA'S SOIL PRODUCTS.

REVIEW OF THE CROP SEASON, 1896.

The crop season of 1896 in Iowa was characterized by an excess of heat and moisture, especially during the periods of seeding and harvesting.

The winter months were milder than usual, with less than the usual amount of precipitation, making favorable conditions for wintering stock. March was cool and dry, with frequent duststorms of considerable severity, causing delay and inconvenience in early spring work on the farms.

The first week in April brought a cold wave of considerable severity, with high winds and freezing weather on the 1st and 3d, and sharp frosts nearly every day until the 10th, which was the date of the last killing frost observed within the state. The second and third decades of the month were excessively warm and wet; the daily mean temperature for the state for the full month being 5.5° above normal, and the rainfall 2.42 inches in excess of the April average. The high temperature and frequent showers in the second and third decades pushed vegetation forward with unusual rapidity, and at the close of the month the season was rated ten days early. It was a notably favorable month for farm work and the germination of crops.

The mean temperature of May was 5.8° above the normal; and the records of the U. S. Weather Bureau stations within the state show that it was the warmest May since 1881. The average rainfall was 6.69 inches, which is 2.54 inches above the normal. The bulk of the rainfall occurred in the second decade of the month. Nearly all parts of the state suffered to some extent from excess of moisture, and from the effects of heavy windstorms accompanying the rainfall. The first decade of the month afforded generally favorable conditions for planting and cultivating corn,

and the outcome of the season approves the wisdom of those who vigorously pushed the work within that time. From the 10th to the 27th frequent showers and occasional heavy rains retarded field work in nearly all parts of the state.

The month of June was notably genial and favorable to all forms of life. The mean temperature was about normal, and the average rainfall was 3.11 inches, which is 1.84 inches below the normal for this state. But the ample supply of moisture stored in the soil by excessive rainfall in April and May prevented any injury to crops by the shortage in June. All crops made excellent progress, and conditions were favorable for field work. An unusually large acreage of hay was cut before the close of the month.

The mean temperature of July was about normal, and the average rainfall was 2.60 inches in excess. The first half of the month was generally fair; the latter half was showery and cloudy, with conditions generally unfavorable for harvesting and stacking the small grain crops. The oats crop, which at an early period was unusually promising, was badly damaged by rust and lodging before harvest, and its ruin was well nigh completed by excessive heat and moisture after it was cut and shocked. Other small grain crops were badly injured by the same unfavorable conditions.

The daily mean temperature of August was about normal, but the first half of the month brought the highest temperature of the season, and the protracted heated term was phenomenally severe on account of excessive humidity. The frequent showers and high percentage of humidity of the first half of August, following the excessive rainfall in the latter part of July, made the harvest season of 1896 one of the most unfavorable ever known in this state. Pastures, meadows, and vegetation generally were given a season of luxuriant growth, but the ripened grain crops suffered material damage.

The corn crop was unusually heavy and promising in the latter part of August, but the weather conditions in the last week of that month and the first half of September were unfavorable for ripening the late planted fields. The month of September was unseasonably cool and wet, with less than the average amount of sunshine; and heavy frosts in the last decade of the month brought the growing and ripening season to a premature close. The early planted fields, comprising the larger part of the corn crop, were fairly well matured and prepared for the advent of freezing weather. But the crop as a whole will not make the phenomenal yield that was promised in midsummer.

The season as a whole has been fairly good, and the growth of all kinds of vegetation has been phenomenally heavy. If the conditions had been as favorable for harvesting small grain, and for ripening the corn crop, as they were for the growth of grasses and other forms of vegetation, the summer of 1896 would have been notable among the seasons of great productiveness.

For study and comparison we give below a table showing the average rainfall in inches for Iowa, in the six crop months—April 1st to October 1st—for the years from 1890 to 1896, inclusive:

YEARS.	April.	May.	June.	July.	August.	September.	Totals.
1890.....	1.78	3.54	7.76	1.98	3.41	2.97	21.46
1891.....	2.15	3.18	6.29	4.22	4.24	1.33	21.61
1892.....	4.75	8.77	9.19	6.89	12.34	1.53	53.77
1893.....	4.21	3.45	3.91	8.33	12.33	2.94	45.20
1894.....	3.07	1.97	3.97	6.63	1.58	3.57	13.90
1895.....	2.63	3.18	4.32	3.49	4.43	3.03	21.99
1896.....	2.68	3.11	6.90	3.52	4.09	29.33	
Normal.....	2.90	4.15	4.95	4.30	3.90	3.70	23.30

The total precipitation for the state for the nine months ending September 31st has been 31.62 inches. The normal for that period is 23.22 inches, showing an excess for the year thus far of 3.40 inches.

JUNE CROP REPORT.

The crop season of 1896 was, on June 1st, about ten days early, compared with the average of former years. The high temperature and excessive rainfall in April and May, causing semi-tropical weather conditions, produced an abnormally rapid growth of vegetation. Seeding, planting and cultivating have been materially delayed by frequent showers and excess of moisture in the fields, so that farm work is generally belated, compared with the season of crop growth. Early planting has this season brought the best results, giving promise of the most abundant harvest.

Since June 1st there has been a material lowering of the condition of corn, oats, spring wheat and barley, on account of heavy rains in large portions of the state. If these reports had been made the 10th instead of the 1st they would undoubtedly be several points lower as to condition of cereals and acreage of corn. On the 1st a considerable area of land prepared for corn had not been planted, though it was included in the estimates of acreage. Some of this will not be planted this season and it is probable that on account of abandonment of wet fields the acreage of corn will this year be from 5 to 10 per cent less than in 1895. We shall call for a revised report of acreage of corn in the July report.

Winter Wheat.—Compared with 1895 the acreage of winter wheat appears to be decreased 6 per cent, making a present acreage of 197,150 acres. Average condition, 94 per cent.

Spring Wheat.—Acreage increased 2 per cent, making present area 542,095 acres. Condition, 96 per cent.

Corn.—According to the state census report for 1895 the acreage of corn in 1894 was 8,648,504. Accepting this as the official basis of estimates, the acreage of corn planted this year is about 8,562,416. The condition June 1st was estimated at 89 per cent. We think that later investigations will show the acreage estimate to be too high.

Oats.—Acreage, 4,346,110; average condition June 1st, 101 per cent.
Rye.—Acreage 121,670 acres; condition, 98 per cent.
Barley.—Acreage 547,642 acres; condition, 99 per cent.
Timothy and Clover.—Show a slight decrease of area, the present acreage being about 2,250,960 acres; condition of timothy, 97; clover, 101 per cent.
Millet.—Condition, 98 per cent; considerable seeding after June 1st.
Flax.—Acreage, 196,128 acres; condition 96 per cent.
Broom Corn.—Acreage, 1,344 acres; condition, 95 per cent.
Potatoes.—Acreage reduced 8 per cent compared with 1895; probably about the same as in 1894, 170,285 acres; condition, 99 per cent.
Sweet Potatoes.—Condition, 97 per cent.
Sorghum.—Condition, 93 per cent.
Fruit.—Condition of apples, 87; pears, 76; plums, 59; peaches, 85; grapes, 90; blackberries, 91; raspberries, 95; strawberries, 89; currants, 71; cherries, 70.
Live Stock.—Cattle, 101; sheep, 100; hogs, 90; spring pig crop, 85; horses, 95; foals, 78.
 Meadows are rated at 102 and pastures at 100 per cent.

JULY CROP REPORT.

The month of June was generally favorable for the growth of the principal crops, the temperature being about normal, and the moisture sufficient for the needs of vegetation. The rank growth of oats and other spring grain crops, caused by the excessive heat and moisture of the preceding months, resulted in material injury by rust and lodging, the oats crop suffering the greatest amount of damage. The report shows an average decline of oats, 10 points; winter wheat, 3; spring wheat, 9; barley 2, and rye 5, as a result of the conditions referred to above. Corn has steadily gained and gives promise of attaining the normal standard.

The revised reports on the acreage of corn show it to be 98 per cent, compared with the area harvested in 1895. This would indicate a present acreage of 8,475,000 acres, on the basis of the state census returns for the year 1894.

The average condition of the staple crops July 1st is shown to be as follows:

Winter wheat, 91; spring wheat, 87; corn, 93; oats, 91; rye, 93; barley, 97; timothy, 95; clover, 100; millet, 95; flax, 94; broom corn, 91; potatoes, 100; sweet potatoes, 95; sorghum, 92; apples, 83; pears, 33; plums, 44; peaches, 88; grapes, 92 per cent.

AUGUST CROP REPORT.

The reports of correspondents of this bureau for August make a fair showing as to the condition of corn and other growing crops. The weather was unseasonably wet during the last half of July, and while this was favorable to corn, grass and potatoes, the frequent showers were very damaging

to unstacked grain and hay. Oats suffered great injury, especially in the central and southern districts. The following figures show the average condition of the unharvested crops:

Corn, 98 per cent; millet, 97; flax, 97; broom corn, 95; potatoes, 91; apples, 89; grapes, 95; pastures, 103.

Threshing reports and estimates indicate an average yield per acre of harvested crops, as follows:

Oats, 26 bushels; winter wheat, 18; spring wheat, 14; rye, 16; barley, 35. Yield of timothy hay per acre, 1.6 tons; clover hay, 1.8 tons.

DECEMBER CROP REPORT.

The general crop report for the season of 1896 is herewith submitted, showing average yield by counties of staple farm products, and average prices at stations nearest the farms on December 1st.

The estimates of total yield of the various crops for the state are made on the basis of the data contained in the Iowa census report for 1895, with estimates of increase or decrease of acreage in the years intervening since the crop season of 1894:

Winter Wheat.—The number of acres sown in 1894 and harvested in 1895, according to the census, was 269,613. There appears to have been a slight decrease in the acreage harvested in 1896, the number of acres this season estimated to be 197,150. Average yield, 17 bushels per acre; total bushels for the state, 3,351,550. Average price, 60 cents per bushel; value of product, \$2,010,930.

Spring Wheat.—Number of acres harvested, 542,095; average yield per acre, 13 bushels; total yield, 7,047,235 bushels. Average price per bushel, December 1st, 57 cents; total value, \$4,016,923.

Corn.—The total acreage of corn grown in Iowa this season is involved in some doubt. According to the census, the acreage in 1894 was 8,648,804 acres. I believe those figures are from 1,000,000 to 2,000,000 above the actual acreage of that year, but until the new census is made by the assessors in 1897, we must accept the official basis at hand. Estimating a decrease of about 7 per cent, we have this season 8,043,390 acres. The average yield is 39 bushels per acre; total product, 313,692,210. Average price, 14 cents per bushel; total value, if all sold at that price, \$43,916,904.

In quality the crop is somewhat disappointing. An unusually large per cent is soft and in poor condition to crib. The harvesting season has been quite unfavorable, and it is probable that above 50 per cent of the crop was still in the fields December 1st. Compared with the crop of 1895, the corn output of this season will fall short in feeding value fully 15 per cent. The yield per acre is heavier than usual.

Oats.—The acreage sown was about 4,346,000 acres. Prior to July 1st the condition of the crop was promising, but by the combined effects of blight, rust, lodging and unfavorable harvest weather, the output has been the poorest ever grown in Iowa. Of the total acreage seeded, not

more than 65 per cent was harvested and threshed, and a considerable percentage of the grain that was garnered was not worth the cost of harvesting and threshing. The average yield by measure of the area harvested appears to be 26 bushels per acre, which, by weight, would not exceed an average of 33 bushels. This, on an acreage of 2,835,000 acres harvested and threshed, would give a total yield of oats by measure of 73,420,000 bushels. The average price, 12 cents per bushel, worth December 1st, \$8,814,000.

Rye.—Acreage, 121,670; yield per acre, 16 bushels; total product, 1,946,720 bushels. Average price, 25 cents per bushel; total value, \$486,680.

Barley.—Acres harvested, 347,642; average yield, 29 bushels per acre; total product, 15,881,618 bushels. Average price, 20 cents per bushel; value, \$3,176,323.

Buckwheat.—Acreage, 8,740 acres; yield, 17 bushels per acre; total yield, 147,380 bushels. Worth, December 1st, \$61,983.

Flax.—Acreage, 199,128 acres; average per acre, 9½ bushels; total product, 1,891,716 bushels. Value, \$1,135,029.

Potatoes.—Acreage, 170,355 acres; yield per acre, 87 bushels; product, 14,814,795 bushels. Value, \$2,963,959.

Sweet Potatoes.—Acres planted, 3,560; yield per acre, 81 bushels; product, 288,360 bushels. Value, \$201,852.

Timothy Seed.—Acres cut, 170,000; average yield, 5.8 bushels per acre; total product, 646,000 bushels. Value, \$678,300.

Clover Seed.—Number acres cut, 61,000; average yield, 2 bushels per acre; product, 122,000 bushels. Worth, \$306,500.

Sorghum.—Acres planted, 19,000; average yield per acre, 90 gallons; total yield, 1,710,000 gallons. Worth, \$615,600.

Hay (tame).—Acres, 2,350,000; average yield, 1½ tons per acre; total, 3,575,440 tons. Value, \$19,193,980.

Prairie Hay.—Acres cut, 1,550,000; average yield, 1½ tons per acre; total product, 2,325,000 tons. Value, \$7,672,500.

Millet and Hungarian Hay.—Acres cut, 90,000. Value, \$840,000.

Hungarian and Millet Seed.—Estimated value, \$50,000.

Broom Corn.—Average yield, 8 of a ton per acre. Value of product, \$48,160.

Vegetables and Roots.—Estimated value, \$475,000.

Nursery Stock.—Sold, \$230,000.

Apples.—Value of product (estimated), \$3,500,000.

Grapes and Other Fruits.—Estimated value, \$445,000.

Market Garden Products.—Value, \$370,000.

Average farm prices of horses, \$37 per head; milk cows, \$26; wool, 11 cents per pound.

The amount of fall plowing compared with average is 83 per cent. The honey crop is 93 per cent of an average, and is worth \$91,000.

GENERAL CROP SUMMARY

PRODUCTS.	No. acres.	Average per acre.	Total prod- uct.	Value.
Winter wheat.....	197.130	17 bu/s.	3,351.250 bu/s.	\$ 2,010.000
Spring wheat.....	542.065	18 bu/s.	7,747.253 bu/s.	4,656.500
Barley.....	5,613.200	25 bu/s.	141,830.000 bu/s.	43,918.500
Oats.....	2,825.000	25 bu/s.	70,625.000 bu/s.	21,193.750
Rye.....	121.870	16 bu/s.	1,949.920 bu/s.	8,714.200
Clay.....	547.643	29 bu/s.	15,881.618 bu/s.	3,719.223
Huckwheat.....	8.740	11 bu/s.	96.140 bu/s.	1,193.93
Flax seed.....	100.189	9 bu/s.	901.701 bu/s.	31,793
Flax.....	3.560	87 bu/s.	310.070 bu/s.	11,392.50
Sweet potato.....	170.040	3 bu/s.	510.120 bu/s.	2,922.300
Timothy seed.....	170.040	3 bu/s.	510.120 bu/s.	204.862
Timothy.....	61.000	2 bu/s.	122.000 bu/s.	1,100.000
Sorghum.....	2,350.000	2 bu/s.	4,700.000 bu/s.	300.500
Hay (name).....	1,500.000	1.5 tons.	2,250.000 tons.	613.000
Hay (name).....	1,500.000	1.5 tons.	2,250.000 tons.	7,672.500
Mill feed.....	1,500.000	1.5 tons.	2,250.000 tons.	147.500
Broom corn.....	1,500.000	1.5 tons.	2,250.000 tons.	475.000
Vegetables and roots.....	1,500.000	1.5 tons.	2,250.000 tons.	845.000
Nuts.....	1,500.000	1.5 tons.	2,250.000 tons.	200.000
Apples.....	1,500.000	1.5 tons.	2,250.000 tons.	2,500.000
Grapes, etc.....	1,500.000	1.5 tons.	2,250.000 tons.	375.000
Carries truck.....	1,500.000	1.5 tons.	2,250.000 tons.	90.000
Honey crop.....	1,500.000	1.5 tons.	2,250.000 tons.	2,225.000
Passenger.....	1,500.000	1.5 tons.	2,250.000 tons.	90.000
Corn fodder.....	1,500.000	1.5 tons.	2,250.000 tons.	90.000
Total value.....				\$134,604.875

From the above it appears that the total value of soil products this season is about \$133,664,623 at the low prices prevailing December 1st. Of course it will be understood that no allowance is made for the large increment of value resulting from consuming these products on the farms, in the production of beef, pork, mutton, dairy products, poultry, etc.

In their completed marketable form these products will bring at least 50 per cent above the minimum prices noted above.

TABLE SHOWING AVERAGE YIELD BY COUNTIES

COUNTIES.	AVERAGE YIELD PER ACRE BY COUNTIES.																	
	Winter wheat, bu.	Spring wheat, bu.	Corn, bu.	Oats, bu.	Rye, bu.	Barley, bu.	Timothy seed, bu.	Clover seed, bu.	Millet seed, bu.	Flea seed, bu.	Broom corn, tons.	Irish potatoes, bu.	Sweet potatoes, bu.	Sorghum, gals.	Stock wheat, bu.	Tame hay, tons.	Straw hay, tons.	
Adair.....	20	22	19	17	16	40	3.6	1.4	12	18	78	50	275	20	15	1.6	1.3	
Adams.....	19	16	14	12	10	35	3.0	1.3	10	15	100	50	275	20	15	1.6	1.3	
Altamaha.....	19	16	14	12	10	35	3.0	1.3	10	15	100	50	275	20	15	1.6	1.3	
Appling.....	14	12	10	8	7	25	2.5	1.0	10	12	113	51	285	19	14	1.4	1.2	
Ashland.....	19	16	14	12	10	35	3.0	1.3	10	15	100	50	275	20	15	1.6	1.3	
Bacon.....	19	16	14	12	10	35	3.0	1.3	10	15	100	50	275	20	15	1.6	1.3	
Black Hawk.....	19	16	14	12	10	35	3.0	1.3	10	15	100	50	275	20	15	1.6	1.3	
Bolton.....	19	16	14	12	10	35	3.0	1.3	10	15	100	50	275	20	15	1.6	1.3	
Boone.....	19	16	14	12	10	35	3.0	1.3	10	15	100	50	275	20	15	1.6	1.3	
Bremer.....	20	14	12	10	8	30	3.0	1.3	10	15	100	50	275	20	15	1.6	1.3	
Bucklin.....	19	16	14	12	10	35	3.0	1.3	10	15	100	50	275	20	15	1.6	1.3	
Buena Vista.....	19	16	14	12	10	35	3.0	1.3	10	15	100	50	275	20	15	1.6	1.3	
Butler.....	19	16	14	12	10	35	3.0	1.3	10	15	100	50	275	20	15	1.6	1.3	
Calhoun.....	19	16	14	12	10	35	3.0	1.3	10	15	100	50	275	20	15	1.6	1.3	

TABLE SHOWING AVERAGE YIELD BY COUNTIES—CONTINUED

COUNTIES.	AVERAGE YIELD PER ACRE BY CROPS.																	
	Wheat, bu.	Spring wheat, bu.	Corn, bu.	Oats, bu.	Rye, bu.	Barley, bu.	Timothy seed, bu.	Clover seed, bu.	Millet seed, bu.	Flax seed, bu.	Broom corn, tons.	Irish potatoes, bu.	Sweet potatoes, bu.	Sorghum, gals.	Black-wheat, bu.	Tame hay, tons.	Prairie hay, tons.	
Carroll	17	17	30	16	16	16	8.6	2.0	14	9	2	77	24	45	15	1.6	1.6	
Cass	17	17	30	16	16	16	8.6	2.0	14	9	2	77	24	45	15	1.6	1.6	
Cedar	17	17	30	16	16	16	8.6	2.0	14	9	2	77	24	45	15	1.6	1.6	
Cerro Gordo	18	18	31	17	17	17	8.7	2.1	15	10	3	78	25	46	16	1.7	1.7	
Decorah	18	18	31	17	17	17	8.7	2.1	15	10	3	78	25	46	16	1.7	1.7	
Dickens	18	18	31	17	17	17	8.7	2.1	15	10	3	78	25	46	16	1.7	1.7	
Charles	19	19	32	18	18	18	8.8	2.2	16	11	4	79	26	47	17	1.8	1.8	
Chickasaw	19	19	32	18	18	18	8.8	2.2	16	11	4	79	26	47	17	1.8	1.8	
Clayton	19	19	32	18	18	18	8.8	2.2	16	11	4	79	26	47	17	1.8	1.8	
Clinton	20	20	33	19	19	19	8.9	2.3	17	12	5	80	27	48	18	1.9	1.9	
Clarendon	20	20	33	19	19	19	8.9	2.3	17	12	5	80	27	48	18	1.9	1.9	
Dallas	19	19	32	18	18	18	8.8	2.2	16	11	4	79	26	47	17	1.8	1.8	
Davis	19	19	32	18	18	18	8.8	2.2	16	11	4	79	26	47	17	1.8	1.8	
DeWitt	20	20	33	19	19	19	8.9	2.3	17	12	5	80	27	48	18	1.9	1.9	
Delaware	20	20	33	19	19	19	8.9	2.3	17	12	5	80	27	48	18	1.9	1.9	
Des Moines	20	20	33	19	19	19	8.9	2.3	17	12	5	80	27	48	18	1.9	1.9	
Dickinson	20	20	33	19	19	19	8.9	2.3	17	12	5	80	27	48	18	1.9	1.9	
Dubuque	20	20	33	19	19	19	8.9	2.3	17	12	5	80	27	48	18	1.9	1.9	
Emmet	20	20	33	19	19	19	8.9	2.3	17	12	5	80	27	48	18	1.9	1.9	
Essex	20	20	33	19	19	19	8.9	2.3	17	12	5	80	27	48	18	1.9	1.9	
Floyd	20	20	33	19	19	19	8.9	2.3	17	12	5	80	27	48	18	1.9	1.9	
Franklin	20	20	33	19	19	19	8.9	2.3	17	12	5	80	27	48	18	1.9	1.9	
Frederick	20	20	33	19	19	19	8.9	2.3	17	12	5	80	27	48	18	1.9	1.9	
Grant	20	20	33	19	19	19	8.9	2.3	17	12	5	80	27	48	18	1.9	1.9	
Guthrie	20	20	33	19	19	19	8.9	2.3	17	12	5	80	27	48	18	1.9	1.9	
Hamilton	20	20	33	19	19	19	8.9	2.3	17	12	5	80	27	48	18	1.9	1.9	
Hancock	20	20	33	19	19	19	8.9	2.3	17	12	5	80	27	48	18	1.9	1.9	
Hardin	20	20	33	19	19	19	8.9	2.3	17	12	5	80	27	48	18	1.9	1.9	
Harrison	20	20	33	19	19	19	8.9	2.3	17	12	5	80	27	48	18	1.9	1.9	
Hawley	20	20	33	19	19	19	8.9	2.3	17	12	5	80	27	48	18	1.9	1.9	
Howard	20	20	33	19	19	19	8.9	2.3	17	12	5	80	27	48	18	1.9	1.9	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20	20	9.0	2.4	18	13	6	81	28	49	19	2.0	2.0	
Jackson	21	21	34	20	20													

TABLE SHOWING AVERAGE YIELD BY COUNTIES—CONTINUED.

COUNTIES.	AVERAGE YIELD PER ACRE BY COUNTIES												
	Winter wheat, bu.	Spring wheat, bu.	Corn, bu.	Oats, bu.	Rye, bu.	Barley, bu.	Timothy seed, bu.	Clover seed, bu.	Millet seed, bu.	Flax seed, bu.	Broom corn, tons.	Irish potatoes, bu.	Sweet potatoes, bu.
Adair	17	12	30	20	15	20	3.5	2.5	10	0.5	8	87	81
Adams	18	13	31	21	16	21	3.6	2.6	11	0.6	9	88	82
Adams	19	14	32	22	17	22	3.7	2.7	12	0.7	10	89	83
Adams	20	15	33	23	18	23	3.8	2.8	13	0.8	11	90	84
Adams	21	16	34	24	19	24	3.9	2.9	14	0.9	12	91	85
Adams	22	17	35	25	20	25	4.0	3.0	15	1.0	13	92	86
Adams	23	18	36	26	21	26	4.1	3.1	16	1.1	14	93	87
Adams	24	19	37	27	22	27	4.2	3.2	17	1.2	15	94	88
Adams	25	20	38	28	23	28	4.3	3.3	18	1.3	16	95	89
Adams	26	21	39	29	24	29	4.4	3.4	19	1.4	17	96	90
Adams	27	22	40	30	25	30	4.5	3.5	20	1.5	18	97	91
Adams	28	23	41	31	26	31	4.6	3.6	21	1.6	19	98	92
Adams	29	24	42	32	27	32	4.7	3.7	22	1.7	20	99	93
Adams	30	25	43	33	28	33	4.8	3.8	23	1.8	21	100	94
Adams	31	26	44	34	29	34	4.9	3.9	24	1.9	22	101	95
Adams	32	27	45	35	30	35	5.0	4.0	25	2.0	23	102	96
Adams	33	28	46	36	31	36	5.1	4.1	26	2.1	24	103	97
Adams	34	29	47	37	32	37	5.2	4.2	27	2.2	25	104	98
Adams	35	30	48	38	33	38	5.3	4.3	28	2.3	26	105	99
Adams	36	31	49	39	34	39	5.4	4.4	29	2.4	27	106	100
Adams	37	32	50	40	35	40	5.5	4.5	30	2.5	28	107	101
Adams	38	33	51	41	36	41	5.6	4.6	31	2.6	29	108	102
Adams	39	34	52	42	37	42	5.7	4.7	32	2.7	30	109	103
Adams	40	35	53	43	38	43	5.8	4.8	33	2.8	31	110	104
Adams	41	36	54	44	39	44	5.9	4.9	34	2.9	32	111	105
Adams	42	37	55	45	40	45	6.0	5.0	35	3.0	33	112	106
Adams	43	38	56	46	41	46	6.1	5.1	36	3.1	34	113	107
Adams	44	39	57	47	42	47	6.2	5.2	37	3.2	35	114	108
Adams	45	40	58	48	43	48	6.3	5.3	38	3.3	36	115	109
Adams	46	41	59	49	44	49	6.4	5.4	39	3.4	37	116	110
Adams	47	42	60	50	45	50	6.5	5.5	40	3.5	38	117	111
Adams	48	43	61	51	46	51	6.6	5.6	41	3.6	39	118	112
Adams	49	44	62	52	47	52	6.7	5.7	42	3.7	40	119	113
Adams	50	45	63	53	48	53	6.8	5.8	43	3.8	41	120	114
Adams	51	46	64	54	49	54	6.9	5.9	44	3.9	42	121	115
Adams	52	47	65	55	50	55	7.0	6.0	45	4.0	43	122	116
Adams	53	48	66	56	51	56	7.1	6.1	46	4.1	44	123	117
Adams	54	49	67	57	52	57	7.2	6.2	47	4.2	45	124	118
Adams	55	50	68	58	53	58	7.3	6.3	48	4.3	46	125	119
Adams	56	51	69	59	54	59	7.4	6.4	49	4.4	47	126	120
Adams	57	52	70	60	55	60	7.5	6.5	50	4.5	48	127	121
Adams	58	53	71	61	56	61	7.6	6.6	51	4.6	49	128	122
Adams	59	54	72	62	57	62	7.7	6.7	52	4.7	50	129	123
Adams	60	55	73	63	58	63	7.8	6.8	53	4.8	51	130	124
Adams	61	56	74	64	59	64	7.9	6.9	54	4.9	52	131	125
Adams	62	57	75	65	60	65	8.0	7.0	55	5.0	53	132	126
Adams	63	58	76	66	61	66	8.1	7.1	56	5.1	54	133	127
Adams	64	59	77	67	62	67	8.2	7.2	57	5.2	55	134	128
Adams	65	60	78	68	63	68	8.3	7.3	58	5.3	56	135	129
Adams	66	61	79	69	64	69	8.4	7.4	59	5.4	57	136	130
Adams	67	62	80	70	65	70	8.5	7.5	60	5.5	58	137	131
Adams	68	63	81	71	66	71	8.6	7.6	61	5.6	59	138	132
Adams	69	64	82	72	67	72	8.7	7.7	62	5.7	60	139	133
Adams	70	65	83	73	68	73	8.8	7.8	63	5.8	61	140	134
Adams	71	66	84	74	69	74	8.9	7.9	64	5.9	62	141	135
Adams	72	67	85	75	70	75	9.0	8.0	65	6.0	63	142	136
Adams	73	68	86	76	71	76	9.1	8.1	66	6.1	64	143	137
Adams	74	69	87	77	72	77	9.2	8.2	67	6.2	65	144	138
Adams	75	70	88	78	73	78	9.3	8.3	68	6.3	66	145	139
Adams	76	71	89	79	74	79	9.4	8.4	69	6.4	67	146	140
Adams	77	72	90	80	75	80	9.5	8.5	70	6.5	68	147	141
Adams	78	73	91	81	76	81	9.6	8.6	71	6.6	69	148	142
Adams	79	74	92	82	77	82	9.7	8.7	72	6.7	70	149	143
Adams	80	75	93	83	78	83	9.8	8.8	73	6.8	71	150	144
Adams	81	76	94	84	79	84	9.9	8.9	74	6.9	72	151	145
Adams	82	77	95	85	80	85	10.0	9.0	75	7.0	73	152	146
Adams	83	78	96	86	81	86	10.1	9.1	76	7.1	74	153	147
Adams	84	79	97	87	82	87	10.2	9.2	77	7.2	75	154	148
Adams	85	80	98	88	83	88	10.3	9.3	78	7.3	76	155	149
Adams	86	81	99	89	84	89	10.4	9.4	79	7.4	77	156	150
Adams	87	82	100	90	85	90	10.5	9.5	80	7.5	78	157	151
Adams	88	83	101	91	86	91	10.6	9.6	81	7.6	79	158	152
Adams	89	84	102	92	87	92	10.7	9.7	82	7.7	80	159	153
Adams	90	85	103	93	88	93	10.8	9.8	83	7.8	81	160	154
Adams	91	86	104	94	89	94	10.9	9.9	84	7.9	82	161	155
Adams	92	87	105	95	90	95	11.0	10.0	85	8.0	83	162	156
Adams	93	88	106	96	91	96	11.1	10.1	86	8.1	84	163	157
Adams	94	89	107	97	92	97	11.2	10.2	87	8.2	85	164	158
Adams	95	90	108	98	93	98	11.3	10.3	88	8.3	86	165	159
Adams	96	91	109	99	94	99	11.4	10.4	89	8.4	87	166	160
Adams	97	92	110	100	95	100	11.5	10.5	90	8.5	88	167	161
Adams	98	93	111	101	96	101	11.6	10.6	91	8.6	89	168	162
Adams	99	94	112	102	97	102	11.7	10.7	92	8.7	90	169	163
Adams	100	95	113	103	98	103	11.8	10.8	93	8.8	91	170	164
Adams	101	96	114	104	99	104	11.9	10.9	94	8.9	92	171	165
Adams	102	97	115	105	100	105	12.0	11.0	95	9.0	93	172	166
Adams	103	98	116	106	101	106	12.1	11.1	96	9.1	94	173	167
Adams	104	99	117	107	102	107	12.2	11.2	97	9.2	95	174	168
Adams	105	100	118	108	103	108	12.3	11.3	98	9.3	96	175	169
Adams	106	101	119	109	104	109	12.4	11.4	99	9.4	97	176	170
Adams	107	102	120	110	105	110	12.5	11.5	100	9.5	98	177	171
Adams	108	103	121	111	106	111	12.6	11.6	101	9.6	99	178	172
Adams	109	104	122	112	107	112	12.7	11.7	102	9.7	100	179	173
Adams	110	105	123	113	108	113	12.8	11.8	103	9.8	101	180	174
Adams	111	106	124	114	109	114	12.9	11.9	104	9.9	102	181	175
Adams	112	107	125	115	110	115	13.0	12.0	105	10.0	103	182	176
Adams	113	108	126	116	111	116	13.1	12.1	106	10.1	104	183	177
Adams	114	109	127	117	112	117	13.2	12.2	107	10.2	105	184	178
Adams	115	110	128	118	113	118	13.3	12.3	108	10.3	106	185	179
Adams	116	111	129	119	114	119	13.4	12.4	109	10.4	107	186	180
Adams	117	112	130	120	115	120	13.5	12.5	110	10.5	108	187	181
Adams	118	113	131	121	116	121	13.6	12.6	111	10.6	109	188	182
Adams	119	114	132	122	117	122	13.7	12.7	112	10.7	110	189	183
Adams	120	115	133	123	118	123	13.8	12.8	113	10.8	111	190	184
Adams	121	116	134	124	119	124	13.9	12.9	114	10.9	112	191	185
Adams	122	117	135	125	120	125	14.0	13.0	115	11.0	113	192	186
Adams	123	118	136	126	121	126	14.1	13.1	116	11.1	114	193	187</

The loss to the state is very heavy. Probably the aggregate will amount to 1,800,000 hogs, of all ages, but mostly less than a year old. The indirect loss is also very heavy, on account of the shipment and slaughter of vast numbers of young animals in various stages of immaturity.

The aggregate loss to the state, direct and indirect, can not fall short of \$15,000,000 for this single season.

WEATHER CROP BULLETINS.

SUMMARIES OF WEEKLY BULLETINS FOR THE CROP SEASON 1896.

BULLETIN NO. 1, APRIL 7TH.

The past winter was milder than the average with less than the normal amount of precipitation and stormy weather, making favorable conditions for wintering stock. March was abnormally cool and dry, with frequent duststorms.

April came in with a cold wave of considerable severity, with high winds and freezing weather on 1st and 2d, retarding farm work. The temperature has been below normal for the past week. The season is somewhat late compared with the average of recent years. But a fair start has been made in seeding and preparing ground for planting. In the southern districts seeding small grain is about completed. In the central and northern districts sowing spring wheat is nearly completed, with a small increase of acreage compared with last year, and considerable progress has been made in sowing other small grain.

The soil is in fine condition for working and for the reception of seed, with sufficient moisture to start vegetation. While the subsoil is extremely dry, there is more moisture at the surface than at the corresponding date last year. Fall wheat and rye wintered fairly well, but were somewhat injured by the high winds and freezing weather of the past week. Pastures and meadows come out in good shape, except some damage to clover from the dry weather in the fall. Stock is generally in good condition, and there is an ample supply of forage on hand.

BULLETIN NO. 2, APRIL 14TH.

The past week brought a rare variety of weather, with a notable commingling of winter and summer conditions. A general storm began on the 7th and continued until the 9th, the precipitation in many localities in the northern and central districts taking the form of snow, sleet, hail and rain, the temperature being near the freezing point. This was followed by much warmer weather, with frequent scattered showers, the maximum temperature ranging from 75° to 90°.

Reports from all parts of the state show that the drouth has been effectually broken, the measurements of precipitation ranging from one to four inches. There is ample moisture in all sections and in many localities the soil is thoroughly soaked. The bulk of the precipitation has been absorbed by the thirsty earth. Farm work has been delayed and

some seeding of small grain remains to be done in nearly all districts. A fair start has been made in plowing for corn. Farmers are pushing things on all lines with renewed confidence. Grass has made a vigorous start. In the districts where winter wheat is grown reports are generally more favorable. There are indications of an increased acreage of spring wheat, compared with last year, and a probable decrease in the acreage of oats. More than the usual amount of grass seed is being sown. Fruit buds are swelling and no damage is reported.

BULLETIN NO. 3, APRIL 21ST.

The high temperature and abundant rainfall of the past two weeks have brought the season forward rapidly to normal conditions, and in some respects it is now in advance of the average. The past week was unusually warm, and all conditions were favorable for farm work and the growth of vegetation. The daily mean temperature ranged from 5° to 15° above normal, the least excess being registered in the northwest section. The rainfall, in form of light showers, was ample to maintain sufficient soil moisture for present needs. Seeding of small grain is now practically completed and fair progress has been made in plowing for corn. With continuance of favorable weather, planters will be in operation before the close of the month. Early sown grain is up, and generally shows a good stand. Spring wheat is especially promising, and winter wheat is generally in good condition in the central and southern districts. But one report has been received of extensive damage to this crop. Pastures and meadows have made rapid growth, and in some sections pasturage is ample for the support of stock. Early varieties of fruit are in bloom in the southern districts, and in all districts the prospect is excellent.

BULLETIN NO. 4, APRIL 28TH.

The daily excess of temperature during the past week ranged from 3° to 9°, and there was an average amount of sunshine. The rainfall was considerably above the normal in the northern and central districts. For the month of April the total precipitation is now from 1 to 3 inches above the normal for the state at large, and in all sections there is an ample reserve of moisture in the soil and subsoil. These favorable conditions have brought all forms of vegetation forward with unusual rapidity, and in respect to the growth of plants and foliage the season is now earlier than the average. Oats, barley, spring wheat, fall wheat and rye have been greatly benefited, and in all sections of the state pasturage is now ample for the support of stock.

Farm work has been vigorously pushed and a large area is ready for planting. Some corn has been planted in the southern districts, and with favorable weather this work will be quite general within the coming week. A good beginning has been made in planting potatoes. The light frosts reported on the mornings of the 22d and 23d did no damage, and the fruit prospects continue to be quite promising.

BULLETIN NO. 5, MAY 5TH.

The average temperature for the state during the past week was a little above normal, much the greater excess being recorded in the southern districts. The percentage of sunshine was generally far below the normal. The reports show excessive rainfall in the larger part of the

state, the lowest measurements being recorded in the south central and southeast districts. Following are some of the highest figures reported: Plymouth, 5.01 inches; Woodbury, 3.93; Webster, 3.53; Osceola, 3.35; O'Brien, 3.23; Jasper, 3.23; Black Hawk, 3.00; Wright, 2.93; Harrison, 3.18; Carroll, 2.58; Crawford, 2.82; Marshall, 2.15; Buchanan, 2.02; Humboldt, 2.20; Franklin, 2.31; Bremer, 2.76; Howard, 2.53; Ida, 2.38; Tama, 2.84. These figures show a wide distribution in the northern and central districts. But there are no complaints of superabundant rainfall, and there are comparatively few reports of damage caused by the heavy storms of the week. It may therefore be set down as another favorable week in this most promising season. Small grain and grasses are doing remarkably well in all sections. Pasture is abundant, and the hay crop promises to be unusually heavy. Plowing and planting were retarded by the wet weather in all sections where there was an excess of moisture. In the southeast, and portions of other southern districts, about half the usual acreage of corn has been planted; and in all of the southern half of the state a good beginning has been made. Within the coming week, if weather is favorable, the planting operations will be general.

BULLETIN NO. 6, MAY 12TH.

The past week was unreasonably hot and generally dry, with more than an average amount of sunshine and high winds. The daily excess of temperature ranged from 4° to 12°. For the week ending Saturday, the rainfall was but little more than a trace in the larger part of the state. Later reports by wire and mail show that the light showers on Sunday evening extended over a considerable area in the central and northern districts. The southern districts are in pressing need of moisture for the pastures and small grain crops. Conditions were generally favorable for corn planting, and good progress is reported in all sections. In the central and southern districts the work is nearing completion, and by the close of the coming week it will be practically finished in all parts of the state. Early planted corn germinated readily, showing a good stand and color, and the work of cultivation is already well begun in some localities. Grass and small grain have made good advancement, and with timely rains will fulfill their early promise. Chinch bugs are beginning to cause some anxiety in some parts of the southern districts.

BULLETIN NO. 7, MAY 19TH.

The past week was excessively wet and cloudy, with about the normal temperature. Showers have fallen in considerable portions of the state every day since the 9th inst., and in all districts there has been a heavy excess of rainfall. Following are some of the higher measurements reported for the week ending Saturday night: Pottawattamie, 7.75; Carroll, 7.57; Boone, 6.59; Greene, 6.50; Ringgold, 6.36; Mills, 5.26; Union, 5.16; Fremont, 4.81; Osceola, 4.40; Woodbury, 4.41; Ida, 4.15; Wright, 4.89; Cherokee, 4.82; Buena Vista, 5.97; Winnebago, 4.50; Dallas, 3.42; Jasper, 3.34; Palo Alto, 3.28; Davis, 3.00; Tama, 3.60; Marshall, 2.95; Bremer, 3.29; Washington, 3.17; Iowa, 2.82; Clay, 3.93 inches. Adding the heavy showers of Sunday and Monday would give a very great excess during the past ten days. Considerable damage to crops has been done by washing out and flooding in some localities where the heavier downpours occurred.

Corn planting has been retarded, and probably some replanting will be necessitated. In the northern and central districts from 20 to 40 per cent of the corn area remains to be planted, and in some sections the plowing is not completed. The early planted fields show a fair stand, but the weeds are getting a vigorous start. Grass and small grain have made a phenomenal growth. The only drawback is a tendency to rank growth of oats and wheat, which may cause damage by lodging or rust. The hay crop is assured, and will be unusually heavy.

BULLETIN NO. 8, MAY 26TH.

First of the week was cool and cloudy, last half warm, the mean temperature for the week being above normal. The rainfall was generally light during the working days of the week, and the time was well improved wherever the soil was dry enough to plow or plant. Considerable ground remains to be planted in all sections where the rainfall was excessive and the surface low and flat. The acreage planted on bottom lands will be materially lessened. Some progress has been made in cleaning out the early planted fields, but the weeds have made a rapid growth. Cutworms are numerous. The excessive heat and moisture of the season has not been altogether favorable to the best development of small grain crops, especially in sections where the rainfall has been heaviest. Oats and spring wheat show a tendency to become too rank, and there are some reports of lodging. Pastures, meadows, garden vegetables and small fruits are generally excellent.

BULLETIN NO. 9, JUNE 2D.

The temperature the past week was variable, the average for the state being above normal, and the sunshine generally deficient. The rainfall for the week ending Saturday night was unequally distributed, ranging from less than .50 to above 3.50 inches. The heaviest downpours are reported from portions of the east central and northeast districts, where local cloudbursts caused destructive floods. In the larger part of the state the work of planting has been retarded by excessive moisture, and a small percentage of the usual corn acreage remains to be planted. Drying weather is needed to put the soil in condition for completing the work of planting and replanting, and for subduing the weeds that have made a vigorous start in early planted fields. The average condition of all field crops, except grass, has been somewhat lowered by excessive rains. Winter wheat and rye appear to be doing fairly well. Oats, barley and spring wheat show some ill effects of wet weather. But, with favorable weather in the future, all crops may regain their former promising condition. Pastures and meadows are at their best.

BULLETIN NO. 10, JUNE 9TH.

The first half of the week was cool, the last half warm, making the average temperature about normal. There was a large excess of cloudiness, with frequent light showers in many localities, hindering farm work in fields not well drained. On the 5th considerable local damage was caused by cloudbursts in Harrison and Cass counties. Variable reports are received as to the condition of corn. Early planted corn on drained land is doing fairly well, and is well cultivated. The general condition of this crop, however, is below the seasonable average, and the acreage has been

lessened by the excessive moisture. In numerous localities planting is not yet completed, and many fields are weedy. Oats and spring wheat are becoming rank, with a tendency to rust, the result of excessive heat, humidity and rainfall. Fall wheat is doing fairly well. Pastures are luxuriant. Timothy and clover meadows are unusually heavy where the stand is good. In old meadows the yield of hay will be much reduced by the encroachment of blue grass. Army worms have appeared in great numbers in numerous localities, their destructive work being mainly done in grass lands.

BULLETIN NO. 11, JUNE 16TH.

The daily mean temperature of the past week was from 3° to 5° below the seasonal normal, and the sunshine was less than the average. The rainfall was unequally distributed; but all sections received an ample supply, and some localities still report an excess of moisture. The lower temperature has been beneficial in checking the tendency of oats, wheat and barley to rust and lodge, from which these crops have been materially damaged in all sections of the state. Considerable progress has been made in cleaning the corn fields, and the crop is doing fairly well in well drained fields. The planting season has covered a period of over six weeks, and there is a wide range in the size and general condition of the plant. Clover cutting is in progress in all districts, and some timothy meadows have been cut. Clover is heavy, and new meadows generally promise a liberal yield of hay. All reports indicate a light crop in the old meadows. Potatoes and pastures are heavy.

BULLETIN NO. 12, JUNE 23D.

Ideal weather conditions prevailed the past week in the larger portion of the state. The daily mean temperature ranged from 3° to 5° above the seasonal normal, and the amount of sunshine was sufficient. The rainfall was generally light, except in portions of the north central, northeast and east central districts, from which reports are received of heavy local showers. There has been but slight interference with farm work, and good progress is reported in the cultivation of corn and hay making. Corn is generally clean, and in some of the southern districts the early planted fields are being laid by. The corn fields and clover meadows are pushing the farmers, and the harvest of fall grain is close at hand. Some improvement is noted in the prospects of spring grain, especially in sections where dry weather has prevailed, which has checked the tendency to lodge and rust. Complaints of predatory insects have about ceased, and the general tone of reports is more cheerful.

BULLETIN NO. 13, JUNE 30TH.

The temperature of the past week was favorable for all crops, although slightly below the seasonal normal. The rainfall was unequally distributed, numerous localities reporting heavy thunderstorms, with wind squalls of considerable force, on the 24th and 25th. In all sections there is an ample supply of moisture in the soil for the present needs of the crops. Reports from all districts indicate that corn is making good advancement, and a large portion of the crop will be laid by during the coming week. The late planted and replanted fields give promise of producing a fair crop. Oats suffered material injury in all sections visited by

heavy rain and windstorms, a portion of the rank grain being lodged beyond recovery. The full extent of damage cannot as yet be estimated. There are numerous reports of damage to spring wheat by rust. The harvest of hay and fall grain is in progress, and a considerable acreage of barley is about ready for the reaper. The yield of hay is generally satisfactory. Pastures yield abundantly, and the prospect for potatoes was never better.

BULLETIN NO. 14, JULY 7TH.

The high temperature prevalent during a portion of the past week was modified by more than the normal amount of humidity and cloudiness, and timely showers favored the rapid growth of vegetation. The rainfall was generally sufficient, and numerous localities report amounts much above the seasonal normal. The widely extended rain and windstorms on the 2d and 3d caused a material increase of damage to oats and spring wheat by lodging and rust wherever the growth of straw is excessively heavy. Corn has made fine progress in all sections, being mostly laid by in good condition. The harvest of winter grain is practically finished; the cutting of barley is general, and in the southern districts, the oats harvest is begun. Hay making has been delayed in some localities by cloudy and damp weather. Hay crop generally heavy, but the acreage is below the average of former years.

BULLETIN NO. 15, JULY 14TH.

The past week was cool and dry. The daily average temperature was about 3° below normal, and the rainfall barely exceeded a trace in any part of the state. The days were generally bright and warm, but the nights were cool. It was ideal harvest weather. Hay is generally well secured; the winter grain crops are in the stack or threshed; barley is about all cut in the southern and central districts; the oats harvest is in progress in all sections, the ripening being hastened by rust.

All reports show extensive damage to oats by rust and lodging, and in the southern and central districts the prospective yield will scarcely repay the harvesting of a large percentage of the area planted. The northern districts suffered least damage from that cause, but the yield will be cut short in all sections. Spring wheat has been materially injured by rust, but the condition of that crop is much better than that of oats. Corn has made steady advancement in all districts, and its condition is now well up to the normal. Rain is needed in moderate quantities for the pastures, potatoes, corn, and the minor crops, though no material damage has yet resulted from the dry weather of the past ten days.

BULLETIN NO. 16, JULY 21ST.

From the 13th to the 16th the weather was excessively hot and dry, causing some apprehension of damage by hot winds and drouth. This heated term was followed by much cooler weather and copious showers fairly well distributed. The southern and central districts received the heaviest amount of rainfall, the reported measurements ranging from one to five inches. These showers came in good time, and have been of immeasurable benefit to corn, late potatoes, pastures, gardens and all immature crops. The reports show that good progress has been made in the harvest fields, and by the close of the present week the bulk of small

grain will be in shock or stack. Threshing from shock has been begun in all districts with quite variable results. All reports agree that oats are both short in quantity and deficient in weight. Judging by returns thus far received the output for the state will be less than one-third the heavy yield of 1895. Corn is very promising, and received no material damage from the late hot and dry weather.

BULLETIN NO. 17, JULY 28TH.

The week ending Monday, the 27th, was unusually cool from the 23d to the 26th, and the amount of rainfall probably exceeded the aggregate received during any week of the current season. The special corn and wheat stations report the following amounts: Marshalltown, 5.07 inches; Hampton, 3.32; Clinton, 4.41; Charles City, 1.59; Fairfield, 3.53; Maquoketa, 3.53; Iowa City, 3.69; Forest City, 1.40; Waterloo, 4.46; Ogden, 4.08; Cedar Rapids, 3.40; Oasola, 4.21; Centerville, 3.65; Des Moines, 3.67. Numerous other stations give similar reports. This has made very unfavorable conditions for harvesting and threshing, and grain in shock has suffered material injury. Oats received the greater damage, reducing still lower the condition of this unfortunate crop. A short period of dry weather is now much to be desired, to give opportunity to save the unstacked grain. Corn is generally reported in good condition, and there is an ample storage of moisture in the soil to develop and ripen the early and late planted fields. The weather has been very favorable for late potatoes and pasturage, and all immature vegetation.

BULLETIN NO. 18, AUGUST 4TH.

The temperature of the past week was about normal, but the rainfall was excessive and amount of sunshine deficient. For the week ending August 1st, the following are among the heavier amounts of rainfall reported: Dubuque, 5.84 inches; Shelby, 5.13; Butler, 4.85; Jasper, 4.70; Poweshiek, 4.65; Delaware, 4.53; Boone, 4.15; Story, 3.93; Marshall, 3.88; Iowa, 3.53; Carroll, 3.44; Black Hawk, 3.55; Polk, 3.53; Van Buren, 3.40; Tama, 3.31; Jackson, 3; Bremer, 3.33; Woodbury, 2.85; Lee, 5.93; Muscatine, 2.60; Clayton, 2.05; Guthrie, 3; Webster, 2.85; Crawford, 2.54; Pottawattamie, 2.35.

The weather conditions have been very unfavorable for completing the work of stacking and threshing from the shocks. And as a result of the frequent and heavy rains of the past two weeks the unsecured grain has been materially injured by rotting and sprouting. Oats suffered the greater damage, but spring wheat has also been badly hurt. Numerous reports state that stacks of grain have been considerably injured by excessive downpours and heavy winds. Corn is doing notably well, except in some localities where it was broken down by wind and hailstorms on the night of the 26th. On the whole this crop is very promising, and the bulk of it is now in the roasting ear stage. Pastures and meadows show a luxuriant growth.

BULLETIN NO. 19, AUGUST 11TH.

This has been the warmest week of the season, the daily mean temperature ranging from 5° to 8° above normal. The rainfall was very light during the working days of the week, with the exception of heavy local showers in Appanoose county and some other portions of the south central district. On Saturday night and Sunday night the high temperature

was somewhat alleviated by showers with high winds, extending over the greater portion of the state. Some damage to corn is reported from various localities, but the aggregate of loss will not be heavy. Considerable progress has been made in securing the unstacked grain, and threshing has been resumed with varying results. Corn is generally doing remarkably well. The greater portion of the early planted corn is well advanced in the roasting ear stage, and much of it bids fair to be ripe enough to cut before the close of August.

BULLETIN NO. 20, AUGUST 18TH.

High temperature prevailed the first half of the week, which was followed by cooler weather, making an average a little above the normal. The amount of sunshine was below the average. In the larger part of the state showers were frequent, and many localities report excessive rainfall with windstorms of considerable severity, causing some damage to corn and grain in shock and stack. The conditions have been generally unfavorable for securing the unstacked grain, and the aggregate of loss to oats and wheat will be very heavy. The corn crop is so bulky, and generally so well advanced that the local damage by wind and hail will not materially reduce the heavy yield that seems now to be assured. The crop is generally ten to fourteen days early and a large percentage will be practically safe from frost by September 1st. The late planted fields will need four or five weeks favorable weather, to reach full maturity. A good start has been made in late plowing where the soil is sufficiently dry. There is great need now of a long spell of good old fashioned dry weather, such as we used to have in the pioneer days.

BULLETIN NO. 21, AUGUST 25TH.

The week has been unseasonably cool and cloudy, with an excess of rainfall in the larger part of the state. The weather conditions have not been favorable generally for threshing and for ripening the immature crops. Corn is doing fairly well, however, and, if the coming month is as favorable as usual, the quality of the crop will be better for this extension of the ripening period. If a killing frost does not arrive in advance of its normal time, the crop of 1896 will probably break all former records in the yield per acre, though the area harvested will be less than in some former years. A considerable part of the early planted corn will be practically beyond danger of harm by frost by the 15th of September, if it is not further delayed by cool and wet weather. The late planted fields will need four to five weeks of seasonable warmth, sunshine and dryness to fully mature their immense burden of corn. Pastures are excellent, and the meadows are bringing forth a heavy second crop of grass. The yield of clover seed promises to be large. There are numerous indications of shortage in the late potato yield. Hog cholera is beginning to assume a dangerous form in scattered localities.

BULLETIN NO. 22, SEPTEMBER 1ST.

The past week has been cool and dry, with more than an average amount of sunshine. The daily mean temperature was from 3° to 4° below the seasonal normal. Light frosts occurred in numerous localities on the mornings of the 26th and 27th, but no damage is reported. The weather has been quite favorable for farm work and for maturing the unharvested

crops. Corn is ripening slowly, under the most favorable conditions for its normal development. Reports from all districts indicate that a considerable portion of early planted corn is now practically safe from damage by frost. Probably about 60 per cent of the whole acreage planted will require two or three weeks of good weather to reach complete maturity. Threshing is nearing completion, and plowing has progressed rapidly, with good conditions of soil. A considerable acreage is ready for fall seeding. A heavy second crop of hay is ready to harvest. Pastures are fine, and fall feed will be unusually abundant. The yield of flax is generally good. Reports of the potato crop are quite variable, and the prospect is not favorable for an average yield.

BULLETIN NO. 23, SEPTEMBER 5TH.

The past week was cooler than usual, with about the average amount of sunshine and generally light rainfall. The temperature fell dangerously near the frost line on two mornings, but as yet no damage has been done. Corn has made fair progress toward maturity, under favorable conditions for the full development of the grain. Some cutting in early planted fields has been done, and probably more than 50 per cent is ripe enough to cut. While a considerable acreage is practically safe, yet, if a killing frost comes before the 25th inst., there will be more than the usual amount of soft and immature corn harvested this season. To round out the entire crop, all of September is needed, with normal temperature and sunshine. In the sections where fall grain is grown, good advancement has been made in plowing and seeding, under excellent conditions. Nearly all reports indicate a large output of clover seed. Reports as to the potato crop are quite variable, with frequent mention of damage by rotting. Threshing is nearing completion, and the harvest of prairie hay is in progress, with a fine yield. There are numerous reports of hog cholera.

BULLETIN NO. 24, SEPTEMBER 14TH.

The mean temperature of the past week was about normal, and there was a large excess of cloudiness and damp weather. The rainfall was in excess in scattered localities, but the average for the state was below normal. There were but three favorable days for ripening and drying out the corn, but the general condition is fairly good. Reports indicate that the bulk of the crop is practically safe in the northern districts, wherein it is generally farther advanced toward maturity than in the central and southern districts. Outing is in progress in all sections, and in the dairy districts a large portion of the crop will be cut and shocked within the coming week.

For the complete ripening of the fall crop of corn we need from ten days to two weeks of dry, warm weather. From 30 to 35 per cent was planted later than usual, and much of this is still green and quite immature. The potato harvest is begun, with a variable output. Dry weather is needed for harvesting and hulling clover seed. Fall plowing and seeding are being rapidly pushed. More than the usual area will be plowed, the conditions of the soil being favorable.

SPECIAL BULLETIN, SEPTEMBER 22D.

The past week was unseasonably cold, wet and cloudy. The daily mean temperature was 2° to 4° below normal, and the rainfall was largely in excess in the greater portion of the state.

On the mornings of the 19th and 20th heavy frosts were reported in numerous localities in the northern and central districts, with temperatures low enough to form ice in many places. The extent of damage to corn can not as yet be estimated. It is certain, however, that a considerable portion of late planted corn is yet soft, requiring warm, dry weather to become sound and merchantable. There has been thus far in September but little favorable weather for ripening the belated portion of the crop; and the low temperatures and excessive moisture have been detrimental to both early and late corn. With more favorable conditions in the near future a large yield may be harvested; but it cannot reach the high aggregate that would have been secured if normal weather had prevailed for the past three weeks.

Reports indicate that the potato crop will fall considerably below the large output last year.

SPECIAL BULLETIN, SEPTEMBER 29TH.

The temperature of the past week was about 40° below normal, and the deficiency for September to date amounts to over 100°, with a large excess of cloudiness and moisture.

These unfavorable conditions, with severe frosts, have checked the ripening of belated corn, comprising probably 15 to 20 per cent of the entire acreage. This will somewhat reduce the aggregate of the crop, which a month ago promised to break all former records. But with drying weather in the future the total yield of sound corn will fairly sustain the reputation of the leading corn state.

The late potato crop is not likely to reach an average yield.

Fall pastures are extra good. The growth of grass and vegetation generally has been phenomenal.

WEATHER AND CROP NOTES.

FROM MONTHLY REVIEW, JULY, 1896.

The spring and summer of 1896 will score a high record among the wet seasons of this region. It is the more notable from the fact that it follows so closely a period of excessive dryness. For study and comparison we give below a table showing the average rainfall in inches for this state in the months of April, May, June and July, for the years from 1890 to 1895 inclusive:

YEARS.	APRIL.	MAY.	JUNE.	JULY.	TOTAL.
1890	1.73	3.65	7.75	1.06	15.08
1891	5.15	3.15	6.30	4.22	14.91
1892	4.75	8.77	5.19	5.29	24.00
1893	4.21	3.45	3.91	8.33	14.90
1894	5.07	1.87	3.87	.63	8.24
1895	3.62	3.19	4.22	3.40	13.63
1896	5.02	6.69	5.11	6.90	21.72
Normal	3.80	4.15	4.95	4.80	15.00

It will be observed that 1892 and 1896 score the highest records for excess of rainfall during these four critical crop months. The normal or average amount for this state is sixteen inches for the four months, and in the seven years there has been a deficiency in five seasons and an excess in two seasons. And the best average crops have been grown in the seasons when the rainfall was an inch or two below the normal. To show the relation between rainfall and production we give below the average yield per acre of some of the staple cereal crops of this state in the six years, 1890 to 1895, inclusive:

YEARS.	Corn—bushels.	Oats—bushels.	Wheat winter—bushels.	Spring wheat—bushels.	R barley—bushels.
1890.....	12.5	12.5	16	11	24
1891.....	12.5	12.5	16	11	24
1892.....	12.5	12.5	16	11	24
1893.....	12.5	12.5	16	11	24
1894.....	12.5	12.5	16	11	24
1895.....	12.5	12.5	16	11	24

Since 1890 the greatest crops have been harvested in the seasons of 1891 and 1895. By reference to the first table it will be seen that the rainfall in the four crop months of those years was uniformly moderate, and a little short of the normal. The year 1895 brought the best all-round harvests, because the soil had been thoroughly drained and pulverized by the drouth that prevailed in the summer, fall and winter of the preceding year. And upon this well prepared soil there came moderate showers with sufficient frequency to keep the crops growing at their best. In the greater part of the state the rainfall was ample, though the total was two and one-half inches below the normal. It appears that our best crops are grown in the seasons closely following a drouthy period, or just before the opposite extreme is reached.

The oats crop shows the ups and downs of the seasons, with but two good crops in the seven-year period. The yield was better in respect to quality in the extremely dry season, 1894, than in the excessively wet seasons, 1892 and 1896. Excessive heat and moisture in May and June will always knock out oats. And other small grain crops suffer in hot and wet seasons.

The rainfall for the four months—April 1 to August 1, 1896—amounted to as much as the total precipitation for the full year 1894. It has been excessively wet in both seed time and harvest, making it muddy in sowing and "catchy" in reaping. This is an exceptional experience in this section, our wet springs being usually followed by dry periods in mid-summer. It's a marvelous change from an average monthly rainfall of about 3 inches in 1894, to 5.50 inches per month in 1896. What does this signify? Shall we adopt the method of reasoning that has been in vogue in recent dry years, and jump to the conclusion that the people have caused a change of climate by doing something they ought not to have done, or leaving undone something they ought to have done? Is it true

that this region is going to be permanently wet? Will it keep on raining, filling up the ponds and streams, making more vapor to make more showers to be again evaporated and precipitated continually? Have we ruined our climate by planting too many groves, hedges and shelter belts, thereby drawing the rain clouds from long distances to drench our fields with excessive downpours? If the work of man caused the drouth in 1894, shall we not infer that the people are in some way responsible for the excess of moisture in the year of grace, 1896?

No, we think the plea of not guilty could be sustained in any court of competent jurisdiction. The people are not to blame either for excessive rains or parching drouths. Don't chop down trees, or clear off sheltering groves, on the mistaken supposition that they bring too much wet weather. That would be as foolish as tearing out the ditches or damming up creeks to cure drouths. The causes of extremes, or variable seasons, are far above and beyond the reach of human hands. Only the Omnipotent is able to grasp and wield these mighty forces of nature.

This country is not going wet, except at intervals. In due time the pendulum will swing to the opposite extreme, and the lowlands, lake beds and bottoms of sloughs will dry up and once more become arable. Don't be discouraged with these occasional wet seasons. We shall have good, old fashioned, dry summers in the near future to teach us profitable lessons of economy and the proper cultivation of the soil. They are sure to come about as often in the future as in the past fifty years. Don't worry about any change of climate, but so watch and work, and apply brains to your work, that you may reap abundant rewards for your labors in every season, whether wet or dry. This may be done, and the coming farmer will learn how to do it.

Many people take pleasure in seeing the ponds filling up, and the streams again running bank full, after the fashion of the pioneer days in this country, before the impervious old prairie sod had been broken. But they do not observe that these swollen streams are swiftly bearing away thousands of tons of the most fertile matter washed from our fields. Take note of the marvelous productiveness of the low lands that are replenished by spring and autumn floods, where the murky waters deposit their rich burden of fertilizing material year by year. All of that cream of the soil has been washed from the surface of uplands and slopes; and over 95 per cent of the richness is carried to the sea and is a total loss to the soils. We take pleasure in seeing well filled streams, but we much prefer to note the flow of clear, sparkling waters. When all the fields are properly tilled the flowage of streams is lessened, and the waters that find their way into the larger streams, and thence to the sea, are not so heavily burdened with the elements of fertility. On all accounts it is better to carry away the surplus waters through deeply laid tiles than over the surface. By deep culture, subsoiling where it is necessary, and thorough deep tile drainage, we may conserve all the water that can be retained, and get rid of excess with the least damage to our fields.

VALUE OF WEATHER OBSERVATIONS.

Prof. Lorin Blodget, of Philadelphia, recently contributed the following article to the Monthly Bulletin of the Pennsylvania Climate and Crop Service:

"The practical value of climatological observations is now as clear and definite as any branch of the public service whatever, and it cannot be suspended at any time without serious loss. The business interests of every part of the state have come to the point of adapting themselves to the current daily reports of changes, the forecasts made by the National Weather Service, and the comparison of the fixed conditions of climate, determined chiefly by the state services; and this well-earned position of influence and character of authority attached to both departments of the weather service cannot be dropped nor permitted to fail in the current and continued work each has in charge. The state has a duty, as well as the general government, and the body of faithful observers who have furnished records for so many years should be sustained and rewarded to the fullest possible extent.

"It is now almost half a century since the general service of reporting observations of the climate began. It was done earlier by order of the surgeon-general at the military posts and the New York academy, while in this state—Pennsylvania—the Franklin Institute invited co-operation in recording the temperature, rainfall, etc., as early as 1839. From 1848 to 1858, the Smithsonian Institution, at Washington, made extensive preparations for a national system of observations, which, however, produced little in practical results and was practically abandoned in 1858. In 1871, General Myer began the present system of storm and weather reporting. He founded the Weather Bureau, and the singular vigor and practical accuracy of his work attained universal approval, securing from congress full recognition as a permanent executive bureau in the public service. In recent years this branch of the national service has developed greater skill and accuracy than was believed possible, especially in the forecasting and in the forms employed in current illustrations. The public feels its daily value and is conscious of its absolute need of the service rendered.

The several state systems hold a position in respect to the national system much as the state governments do to the general government. They are indispensable as aids and adjuncts to each other, and the state work covers a wide field that the national bureau cannot reach. Each county and each district should be examined and its climate defined. Its productive capacity as to cultivation, its forest growth, its healthfulness, and all other conditions, should be defined by instrumental record and by the establishment of both the mean and the extreme conditions. And, in respect to the range of these extremes, it is certain that continuous records must be made, and that no definitions as to one season or year

will practically apply to the next season or year. The sources from which the very atmosphere comes in its annual movement are as remote, practically, as is the sun as the source of atmospheric heat.

"We have a duty of the broadest and most practical character in thus observing and determining the climate of the state in all its conditions. It is a duty scarcely less imperative than that of providing for the well being of its inhabitants through the ordinary functions of its state government. The work of the service is not speculative nor theoretical as to any of its conditions. Its duty, primarily, is to make permanent records of the facts, and this for as many localities as may be possible, or may be required, to define the climate of every habitable area within the state limits. The difference due to elevation, as well as those of geographical position in other respects, are among the points that should be better known than they now are.

"The sweep of the greater changes and storms that pass over the entire country can better be shown in the work of the national bureau, but there is a share of duty, even in this respect, falling to the hands of the state."

DISTINGUISHING A TORNADO.

HARPER'S WEEKLY.

Perhaps the most important distinction to emphasize is that between the appearance of a thunderstorm and a tornado, since, if this can be defined, much needless fear at the approach of black but harmless thunderstorms can be avoided. When not combined with tornado manifestations the thunderstorms send aloft a narrow line of black clouds in advance, which remain high in the air. At the right and left the black clouds seem to reach the earth, but this is caused not by descent to the earth, as in a tornado, but by distant edges of the high black clouds receding below the horizon. It is one storm which spreads to the left and right. There is no splitting up of clouds with the formation of a different storm at another part of the horizon.

The tornado is easily distinguished from this perfectly plain edge of black, with its lighter rain mist extending to the earth. Whether the funnel is veiled by rain or not it is ordinarily so black that as it approaches it appears as a column of dense darkness, narrowest at the earth, with light breaking through on either side of it. The most marked trait of all is that other clouds seem to be approaching, others moving at right angles, and a distant storm of light hue is coming from the southwest. This is all caused by the tornado, which is drawing clouds and air currents toward itself from great distances. As the tornado funnel comes nearer, with its dark mass of rubbish reaching to the earth, the roar is frightful, giving the observer fifteen or twenty minutes' warning. The southwest corner of the cellar, if the tornado is approaching from the south or west, is the safest place of refuge. The tornado carries the wreckage to the north and east, and if the funnel is seen in the north or east it need not

be feared, because it will almost certainly move away. Of 600 tornadoes specially classified, all but thirty-five moved from southwest to northeast, and nearly all of the thirty-five moved eastwardly.

The funnels have a rotary motion from right to left, and this motion is not due to electrical action, but to acceleration of conflicting air currents. Lieutenant Finley shows that the lightning supposed to be in the funnel is really in adjacent thunder clouds. The broken and withered buds bruised by the action of the air are evaporated by the sun after the tornado, causing the foliage to look seared, giving rise to the error that the tornado manifests burning electrical power. It has been demonstrated by study of wreckage that as the funnel leaves the earth and rises into the air its force slightly diminishes, and that this bounding motion causes the funnel to spare one building and demolish another. The funnel, with its small end to the earth, spins like a top, moving along at an average rate of about forty miles an hour, but the velocity of the spin is incalculable. It is like the motion of air impelled by an explosion.

Tornadoes generally occur between 1 P. M. and 5 P. M., and not one in a thousand takes place between 10 P. M. and noon of the following day. I have heard of only two instances in which the tornado occurred between midnight and morning—one at Hoboken, N. J., and another in the southern part of Michigan, which caused slight loss of life. Since these are only two in about 2,000 cases, the danger from tornadoes at night is so small that it need not be considered.

COLD WAVES IN FORMER YEARS.

Some of the old-time weather records do not appear to sustain the current notion that the work of man on this continent, in the cultivation and drainage of the soil and clearing away portions of the primeval forests, has developed a tendency toward climatic extremes in form of floods, droughts, cold waves, hot winds, etc.

The winter of 1894-5 was unusually severe in the Gulf states. Zero temperatures were recorded in northern Alabama and Georgia, and killing frosts reached the Gulf, resulting in the wholesale destruction of orange orchards far to the southward in the Florida peninsula. This was said to be an unprecedented incursion of the cold waves and winter blizzards into that favorite paradise of northern tourists, and some writers gravely assured us that the extreme effects were produced by clearing away some of the timber in the northern sections of the Gulf states.

The old-time weather records, however, show that severe cold waves and killing frosts occasionally visited that region in the first half of the present century, before the forests had been disturbed. In the Climatology of Alabama, by Prof. P. H. Mell, we find the following notes compiled from the reports of the Smithsonian Institution and other reliable weather records:

"1832. A winter of great severity. At Huntsville, Ala., the thermometer registered 9° below zero."

"1834-5. These were both cold-winters. February 6 and 7, 1835, were exceedingly cold, the temperature being 5° at sunrise."

"1852. Thermometer registered 8° at Mobile, January 20th. The spring was cool, inclement and late."

"1855-6. The winter was the coldest since 1852. Standing water near Mobile was frozen hard enough to permit of skating—a most unusual sight for that latitude."

In 1877 the Bigbee river was frozen over in January. In the winter of 1884-5 the frozen condition of the ground hindered farm work in Alabama. In December, 1886, the temperature in northern Alabama fell to 6° below zero. Snow covered the northern counties to the depth of 30 inches, and 12 inches fell in the southern part of the state. In the January following the cold was severe enough to kill cattle that were not sheltered.

These records indicate that the tendency to extremes in temperature is not of recent origin. Northern Alabama, it should be noted, is quite heavily timbered; yet the cold waves are tall enough to climb over the tallest trees in that region. In matter of flat, cold waves tumble downward from the crests of advancing "highs." It would require a mighty big wall of hills and trees to shut them out.

The New York Sun recently published some interesting reminiscences of old-time winters and sudden onslaughts of cold waves, related by an octogenarian, who was one of the pioneer settlers in Illinois. The old gentleman said:

"I was an Illinois pioneer. My folks settled in a piece of timber in McLean county, known as Keg Grove. The city of Bloomington occupies the site of Keg Grove now. We settled there in 1829. There were only 40,000 people in the whole state of Illinois then. Neighbors were few and far between about Keg Grove.

"The fall and early winter of 1830 were very dry and mild. Late in December, and with very little warning, snow began falling. It didn't fall, either; it tumbled. It came down in regular ready-made snow-banks, and continued, without a moment's let-up, for two days and nights. You may have some idea of how deep the snow fell when I tell you that when it went away in the spring the stumps of trees that had been cut for firewood, as the choppers stood on the snow during the winter, were seven feet high, that being as low down as the choppers could get at the trees. In going to a neighbor's I drove over the tops of their orchard trees and did not know it. It was a fortunate thing that the corn crop had been good that year, for so many families were so blockaded by the snow that they could not get out of their houses. They would have starved to death, but they lived on corn, which they pounded into coarse meal or hominy, and that was so generally the case that the winter was ever afterward known to the pioneers as the hominy winter.

"There was heavy frost every month in the year after that deep snow. Corn couldn't ripen, and there wasn't enough gathered for seed to plant the next season. There wasn't a bushel of seed corn to be had nearer than Ohio in 1832. It cost \$3 a bushel. John Duffy came in that year with a few bushels of small, yellow corn from Pennsylvania. That was planted. It was matured early, and some people out there raise Duffy corn yet.

"But in December, 1836, the prairie pioneers got some weather that made them quit dating things from the winter of the deep snow. The month had been warm and moist. Everything was slush and slop and mud. Suddenly the wind began to blow a gale. It came out of the north-west, and no wind that ever swept over those prairies, before or since, came so near being a blast from the north pole as that one was. Almost instantly the mercury dropped from 40° above to 20° below zero, and the falling rain was turned at once to pellets and barbs of ice. The damp air froze so quickly that it became one great cloud of flying frost.

"This polar blast swept down upon us at 3 o'clock in the afternoon. John Dawson was on his way from Williams' mill, six miles down Salt creek. He had gone half a mile from the mill when he heard a roar like thunder. The noise was behind him. Looking around, he saw the storm coming and the rain freezing before it. When it struck him, he turned to go back to the mill. The slush had been more than fetlock deep. By the time Dawson had urged his horse around a hundred yards, the slush was frozen so it bore the horse's weight, and it was with great difficulty that Dawson got back to the mill, the water in the road having become such a glare of ice that his horse could scarcely make his way over it.

"Fowls that were out on soft ground while this unheard-of change of weather came were frozen fast where they stood. Cows froze in their tracks. Our folks had three hogs frozen to death while they were hurrying from their feeding-places to their pen, less than 300 yards away.

"That cold snap lasted six weeks, and was a spell of weather that made folks shudder whenever they thought of it, even in summer-time, for many a year afterward."

WEATHER MAPS—HIGHS AND LOWS.

In the *National Monthly Weather Review* Prof. A. Cleveland Abbe explains the meaning of some of the lines and terms on the daily weather maps. He says:

"The words 'high' and 'low' are used as contractions for 'high pressure' and 'low pressure.' Inasmuch as atmospheric pressure is measured by the barometer, these expressions are also equivalent to saying that the column of mercury in the barometer is a tall one or a short one. If a syphon barometer is used, the top of the long column is above the top of the short column by a larger or smaller amount; the difference in height between the tops of the long and short column is usually more than 30 inches when the pressure is high and less than 30 inches when the pressure is low and when the station is near sea level. If an aneroid barometer is used, the index or pointer usually turns toward the right hand for higher pressures and toward the left hand for lower pressures.

"The map shows, by means of isobaric-lines, the regions where the pressure is the same. Some of these isobars inclose a region of high pressure and others a region of low pressure. High areas are the regions of high barometric pressure. With the high areas we usually associate cool or cold, dry, clear weather and gentle winds. With the low areas we usually expect warmer, moist, cloudy, and rainy weather and strong

winds, and sometimes also thunderstorms, tornadoes and hailstorms. Therefore the low areas are sometimes spoken of as storm centers.

"The term barometric pressure or simply barometric readings is often used without realizing its meaning in meteorology. Ordinarily we appreciate the temperature of the air by our personal sensations so clearly that when we see a record of 100° F., we instinctively think of the heat and the temperature, and the most ordinary meteorological observer doubtless sees in his mind's eye the relative levity or buoyancy of the air, due to the fact that it is expanded by high temperature. But our nervous organization is not generally sensitive to the ordinary changes of atmospheric pressure; we have not a mechanical sense to tell us of the pressure or push of the ordinary air. Occasionally one will be found whose ears ring when the atmospheric pressure is high or whose nerves pain him when the pressure is low. To the meteorologist, however, the expression high or low pressure conveys an idea of force exerted in compressing the atmosphere and of expansive force within every cubic inch by which it tries to enlarge its boundary. To him a high barometer means that the air is being condensed by pressure, and *vice versa* a low barometer that the air is expanding by reason of the relief of pressure. The pressure ordinarily exerted by the atmosphere is about 15 pounds to the square inch. This pressure would balance the weight of a column of mercury 1 inch square and 30 inches high. This is the pressure that is holding every cubic inch of our lower atmosphere within its bounds; if the pressure relaxes the cubic inch of air expands. If, for instance, the weather map shows that a region of low pressure is advancing upon any station, the observer may expect to find the air within any confined space pushed outward through every possible aperture; the air in the soil comes up; that within a cavern pushes out through the entrance; bubbles of air in liquid expand in size; hermetically sealed cans bulge outward. These and similar phenomena show the observer that the pressure of the atmosphere upon all bodies at the surface of the earth has diminished and that internal pressures that before were counterbalanced by the atmospheric pressure now have the preponderance. The force that pushes the air forward when the wind blows is this atmospheric pressure of about 15 pounds to the square inch, or rather it is the difference in atmospheric pressure, since the full pressure of 15 pounds to the square inch could only come into play when the air or wind is blowing into an absolute vacuum.

"The motion of the wind is the result of pressure from behind just as truly as is the motion of the piston rod of a locomotive engine. The piston usually has the atmospheric pressure of 15 pounds to the square inch on one side of it and the steam pressure of 100 or 200 pounds to the square inch on the other side, and this great difference of pressure is necessary in order that so small a piston can do so much work. The pressure and the action of the steam engine piston are intense. On the other hand, in the atmosphere a small portion of air moving along as a rapid wind has a very little excess of pressure in the rear over that in front. A vertical sheet of air one foot thick moving forward as the front of a violent gust may, for instance, have a pressure of 29.50 inches in front and 29.51 inches in the rear; this difference of .01 of an inch is about 1-2950 of the whole pressure; or about .005 pounds per square inch, or .72 pounds per square foot. Now,

a cubic foot of air weighs about .07 of a pound, and as the above force is continuously pushing this mass, it soon gives it a great velocity, and maintains it at that velocity by continuously overcoming friction and other resistances. The atmospheric pressure pushing from all sides toward a region of low pressure soon sets the air into a whirling motion; it may be on a very small scale, forming a waterspout or a tornado that would scarcely make any show on our daily weather map, or it may be in great whirls, such as constitute hurricanes or other cyclonic storms."

ATMOSPHERIC WAVES.

It is rather startling to be told on high scientific authority that we are living most of the time, submerged in waves to which the greatest waves of the ocean are mere ripples in point of size. This a suggestion or discovery of the late Professor Hemholtz, of Berlin, and the enormous waves are waves of air.

When a current of air blows across a water surface, water waves are produced, and when a current of air blows across a surface of quiet air, or air having a different motion from the first current, then air waves will be produced.

These atmospheric waves, Professor Hemholtz showed, have all of the phenomena of water waves—troughs, crests, foaming, breaking and spraying. But since the qualities of air and water are so different, the air waves have dimensions over 2,500 times those of the corresponding water waves.

Thus the great ocean waves of perhaps twenty-five feet in height would have atmospheric counterparts extending upward a distance of ten or twelve miles above the earth's surface. The passage of the huge air waves would be felt by us, since they would cause a stirring up of the air at the earth's surface somewhat similar to that produced by the passage of water waves over shoal places.

The undulating movement of such air waves would account in part for the intermittent gusts of wind which we notice so frequently in storms.

The presence of these waves is also indicated by the existence of certain kinds of regularly formed cloud groups, in which each cloud marks the crest of an air wave.

This meteorological conception of the great German scientist opens up to observers a very interesting field, and the mere statement of his theory enhances the interest with which we all gaze into this thin medium wherein we live and move and have our being.—F. Waldo.

The general causes which act on the movement of the atmosphere are defined by Professor Cornu, in an address lately delivered before the British Royal Institute, as gyration influences, and, when once the movement is set going, it continues of itself and sometimes increases in amount. In the first place, Professor Cornu declares, the movement of the rotation of

the earth is to be cited, which always brings with it a small component of rotation for a displacement of a gaseous mass in latitude or altitude, and, in the second place, and as decisive a cause, the solar heat, which warms the air near the surface, or the clouds. Thus related, and as the ascending tendency of the heated gas cannot be equal over the whole surface exposed to the rays of the sun—as much because of the nature of the ground as because of its inequalities—the equilibrium is upset in parts and gaseous columns ascend. When once gyration is established, the causes producing it keep it up and augment it.

CLAYTON COUNTY RAINFALL RECORDS—46 YEARS.

(From records kept by Hon. Maturin L. Fisher and Frank Larrabee.)

YEARS.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total for each year.	Total, each decade.
1850	15.15	10.01	60.16	1.70	8.12	8.89	1.41	1.32	1.83	1.04	85.31	73	208.94	
1851	78.14	90.11	19.07	4.30	6.57	4.92	6.00	54.17	70.28	94			70.28	
1852	39.22	14.32	3.21	1.50	8.44	4.13	1.17	0.37	3.99	56.23	35	29	47	
1853	180.10	15.84	53.69	6.09	4.44	5.57	3.52	1.12	1.39	3.15	1.05	33.02		
1854	49.33	47.59	7.16	1.46	6.93	65.02	61.14	44	17.32	07				
1855	95.21	11.41	67.36	8.33	4.35	2.83	77.16	3.24	2.50	23.51				
1856	56.29	20.50	3.49	3.59	3.41	1.89	1.54	1.69	2.47	4.22	29.95			
1857	109.79	121.83	2.67	4.73	2.73	17.51	1.00	2.76	17.49	48				
1858	1.44	201.28	9.23	5.21	7.12	5.90	1.77	215.07	4.42	27	45	11		
1859	1.30	1.29	17.30	3.36	6.49	3.29	1.49	31.03	07	47	29	16	223.37	
1860	1.09	1.21	31.73	3.18	4.49	1.80	1.30	5.94	1.57	17	29	11		
1861	2.47	1.16	1.83	5.72	1.21	2.08	1.99	5.49	2.75	36	126	33	40	
1862	2.40	1.03	0.37	2.91	2.23	3.95	1.37	4.22	1.02	1.31	61	25	64	
1863	1.22	1.41	1.12	88	2.70	1.80	2.97	0.94	1.13	2.05	58	25	50	
1864	1.10	0.81	1.80	1.86	2.77	1.37	0.40	2.94	1.37	1.00	1.13	23	92	
1865	1.49	0.72	78.34	1.10	7.14	3.65	1.22	0.41	3.69	1.05	25	16		
1866	1.79	91.79	23.04	1.21	5.54	5.97	1.75	1.50	2.50	751	44	26		
1867	2.90	1.91	4.03	1.13	5.68	7.13	4.51	1.41	1.39	1.59	02	97	32	57
1868	7.75	70.29	1.17	2.84	4.46	0.31	7.04	1.98	7.01	43	80	24		
1869	1.95	92.76	76.21	4.04	4.78	9.44	4.53	0.61	6.76	753	31	57	903.79	
1870	1.21	94.04	28	1.73	3.35	5.13	0.51	0.71	1.11	291	432	20		
1871	1.11	1.29	23.17	4.15	4.42	1.91	0.97	0.93	2.75	5.09	3.52	27		
1872	1.22	1.60	1.72	3.62	2.48	4.86	3.35	0.91	1.19	6.03	7.00	63	92	
1873	3.85	731.84	31.68	3.84	3.74	1.47	3.11	1.69	3.39	1.99	1.30	39	51	
1874	1.07	1.01	1.61	1.33	4.09	2.93	0.73	0.64	1.29	2.61	22	26	12	
1875	1.61	1.28	70.12	3.08	4.32	4.94	3.74	0.65	1.31	4.02	63	59		
1876	2.45	1.32	433.34	2.65	7.43	4.07	7.75	0.59	1.81	88	44	40		
1877	2.20	0.08	6.61	1.64	2.52	5.61	3.41	7.5	4.84	0.47	1.96	41	11	
1878	1.65	7.87	67.71	5.42	6.54	9.71	654.83	0.96	2.86	94	43			
1879	4.07	1.45	2.20	5.14	3.84	4.34	1.07	1.95	2.79	2.23	1.43	33	302.49	
1880	1.48	1.82	30.23	4.64	7.11	6.94	0.86	0.91	1.00	2.01	2.05	29	25	
1881	1.07	2.11	74.54	3.04	6.82	10.71	0.19	7.69	0.31	6.23	7.14	67		
1882	1.19	7.85	94.31	3.73	6.99	6.62	4.72	2.74	9.82	4.01	96	36	53	
1883	1.80	1.17	331.34	7.04	7.10	7.13	0.71	2.91	1.66	3.20	1.44	42	57	
1884	1.61	1.12	12.19	3.35	3.35	4.29	7.4	0.99	0.96	8.02	10.04	19		
1885	1.62	0.3	35.29	1.71	3.23	8.65	18.47	1.19	1.69	3.31	42	97		
1886	4.19	3.91	32.53	2.46	1.68	1.65	1.73	1.64	4.01	1.01	99	86		
1887	1.02	0.66	1.15	1.07	1.41	3.35	0.19	8.95	7.14	1.14	3.91	32		
1888	1.88	0.24	0.02	4.84	3.42	3.62	1.19	0.91	1.39	1.67	8.93	29	53	
1889	1.58	1.24	16.07	3.06	4.12	1.44	2.19	1.17	1.57	1.94	1.23	24	246.78	
1890	3.31	1.91	0.03	3.96	2.92	3.96	6.62	2.31	2.16	1.26	4.81	39		
1891	1.46	1.12	4.37	1.97	3.85	3.13	0.71	1.37	2.53	1.23	87	28	39	
1892	1.23	2.91	17.33	2.03	3.15	2.34	0.19	1.81	0.61	3.03	1.03	19		
1893	1.24	1.73	614.10	4.24	2.70	6.43	1.01	7.95	1.48	1.02	22	74		
1894	1.07	1.82	0.34	1.75	3.11	0.81	4.34	2.73	1.61	1.05	22	74		
1895	1.26	0.61	74.08	3.44	2.53	1.57	2.31	3.10	7.01	9.62	1.14	30	178.63	
Averages.	1.38	1.21	69.27	3.77	4.72	4.38	2.03	2.02	2.38	1.82	1.57	21	87	

ANNUAL RECORD AT ONAWA, IOWA.

BY C. G. PERKINS, OBSERVER.

YEARS.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
1870	40.1	01.1	07.1	16.4	4.6	4.07	1.17	3.28	9.0	2.80	1.00	1.55	23.33
1880	1.00	09.7	7.1	12.7	7.2	3.47	3.13	1.3	3.47	1.51	0.55	29.49	42.2
1881	1.00	7.0	1.23	0.29	7.2	3.49	4.17	1.60	7.5	1.56	0.55	30.49	42.2
1882	1.80	7.0	4.5	4.95	5.2	8.69	6.19	10.3	15.2	4.21	1.0	30.81	94
1883	1.80	4.45	7.0	0.07	7.4	8.20	4.02	3.5	1.80	2.25	0.5	11.23	68.5
1884	1.50	2.25	4.0	1.93	4.6	4.97	1.04	3.09	4.3	2.2	0.91	21.35	56
1885	1.30	7.5	5.0	8.58	6.3	6.10	0.05	5.52	9.0	2.04	2.8	1.05	43.21
1886	4.85	10.3	6.0	2.02	3.0	3.49	2.05	1.60	3.80	4.54	1.8	1.07	37.15
1887	3.85	4.0	1.44	1.45	4.0	3.45	3.00	3.09	3.7	5.0	5.2	4.57	39.3
1888	1.48	3.4	0.3	3.35	8.2	2.63	3.04	4.05	4.6	7.8	0.8	1.10	37.15
1889	1.56	3.0	2.0	1.85	2.0	7.66	7.60	7.2	0.7	10.40	1.05	2.7	42.2
1890	1.00	3.0	2.0	1.85	2.0	7.66	7.60	7.2	0.7	10.40	1.05	2.7	42.2
1891	1.62	1.07	1.69	1.74	4.3	4.76	4.15	3.11	3.05	2.5	4.1	1.72	36.61
1892	3.8	5.1	6.4	10.6	8.5	1.05	2.09	4.58	5.0	1.90	2.8	8.5	35.75
1893	1.60	2.5	4.1	6.2	4.4	4.73	5.82	5.4	4.0	8.51	1.67	3.7	42.2
1894	7.5	5.0	8.1	8.1	4.1	4.12	2.0	1.90	2.2	1.72	0.5	1.05	16.01
1895	2.5	6.0	1.01	3.54	4.1	9.34	6.7	8.5	3.20	0.0	1.01	1.0	31.97
Averages	1.32	1.12	1.51	2.79	4.61	5.17	4.21	3.93	5.2	2.91	1.05	1.06	31.79

PRECIPITATION DATA.

Average Monthly and Annual Precipitation (rain and melted snow) at various Iowa stations for the period of years named in the last column.

STATIONS.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.	No. of years.
Albion	.91	1.59	3.17	2.64	4.12	5.11	4.54	3.02	3.46	5.67	1.81	1.15	34.45	7
Algona	.90	1.57	1.59	2.22	3.48	4.63	6.04	3.82	3.40	5.21	1.39	.89	37.77	14
Amama	1.43	1.30	1.90	2.72	4.24	4.64	4.18	1.56	3.36	4.24	1.82	1.45	33.91	21
Anna	1.60	1.70	1.49	2.66	4.47	4.79	5.50	3.40	3.24	5.15	1.00	.80	44.15	10
Brookside	1.43	1.67	2.43	3.09	4.82	5.78	5.95	5.29	4.60	6.63	2.24	1.36	46.98	19
Brookville	1.52	1.30	1.69	3.08	4.83	4.97	5.82	4.38	3.50	6.82	2.77	1.82	42.24	11
Cedar Rapids	1.64	1.66	2.57	3.67	4.71	3.84	4.85	3.94	3.85	5.70	1.51	1.75	32.57	13
Cresco	1.35	1.00	1.77	2.10	3.47	5.14	4.33	3.18	3.94	2.36	1.50	1.42	31.45	19
Council Bluffs	.50	1.18	1.57	2.53	3.69	5.65	5.23	3.31	3.45	4.04	1.16	.99	43.36	23
Clinton	1.92	3.32	2.77	3.12	4.47	4.63	4.12	3.63	3.32	2.85	1.90	.11	47.43	11
Davenport	1.64	1.46	2.11	3.80	4.31	4.30	3.73	3.57	3.51	5.38	1.11	1.31	33.99	25
Denmark	1.46	1.66	2.32	3.53	4.47	5.80	3.33	3.52	3.80	3.82	1.97	1.04	35.56	12
Dubuque	1.40	1.70	1.45	3.15	4.62	5.19	5.11	3.41	3.40	5.31	1.97	1.45	35.06	13
Dysart	1.44	1.48	2.21	3.06	4.35	5.11	4.43	3.11	4.19	2.70	3.63	1.83	34.90	23
Fairfield	1.24	1.54	1.73	2.41	3.89	4.97	4.75	3.80	4.70	2.15	1.79	1.58	34.30	11
Elkader	1.46	1.70	1.74	3.01	3.82	4.70	4.23	3.97	3.96	5.72	1.67	1.80	35.31	9
Ft. Madison	1.60	2.08	2.77	3.13	4.30	4.47	5.40	3.89	3.65	2.96	3.23	1.90	37.54	27
Garnaville	1.13	1.11	1.38	2.05	3.33	5.28	4.21	3.02	3.02	4.08	1.69	.80	34.95	7
Glenwood	.84	7.19	1.30	1.49	3.36	4.69	3.76	3.64	3.39	3.43	1.10	.77	39.80	8
Guttenburg	1.14	1.17	1.88	2.33	3.50	5.17	4.82	3.82	3.87	3.34	2.01	1.35	34.18	15
Ida Grove	.33	.89	.84	1.64	3.85	5.14	5.71	4.14	3.63	4.70	1.66	.94	28.42	11
Independence	1.37	1.05	1.79	2.21	4.17	5.00	4.73	3.43	4.70	2.33	1.53	1.48	33.87	22
Iowa City	1.74	1.65	2.68	3.13	4.21	5.04	4.35	3.67	4.24	3.11	2.04	1.74	39.77	23
Kookab	1.72	1.99	2.16	2.93	4.04	4.92	4.19	3.12	4.58	3.12	1.64	1.82	35.77	20
LeClaire	1.52	1.90	3.21	2.71	4.94	5.22	4.09	3.30	3.30	3.49	1.71	1.75	35.20	8

IOWA WEATHER AND CROP SERVICE.

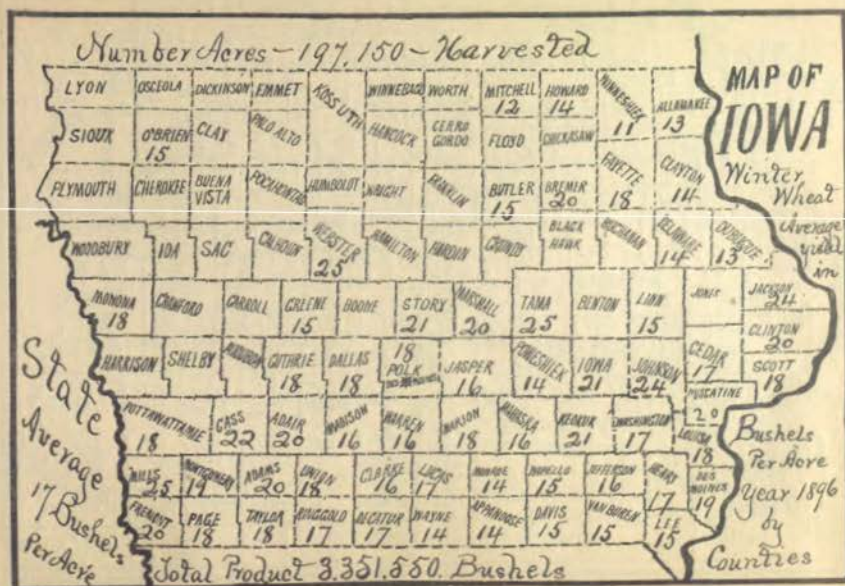
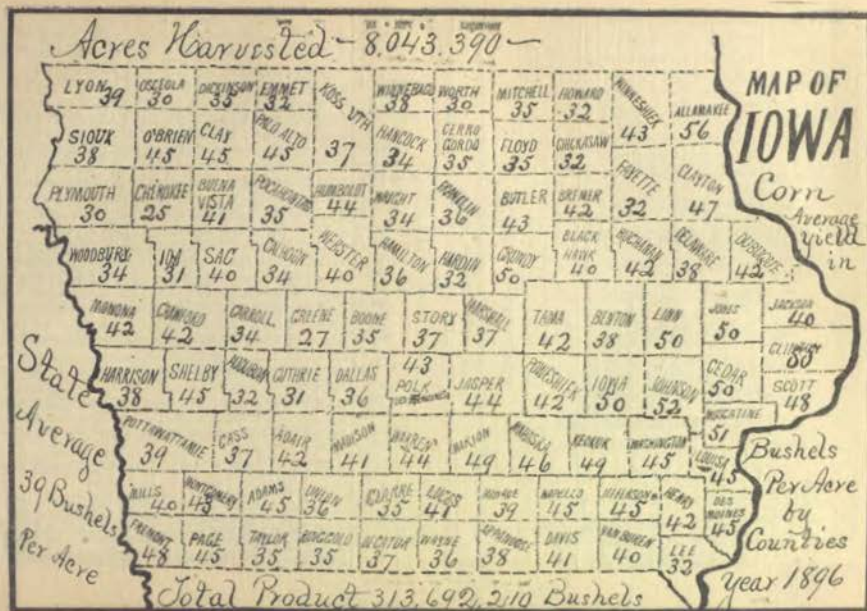
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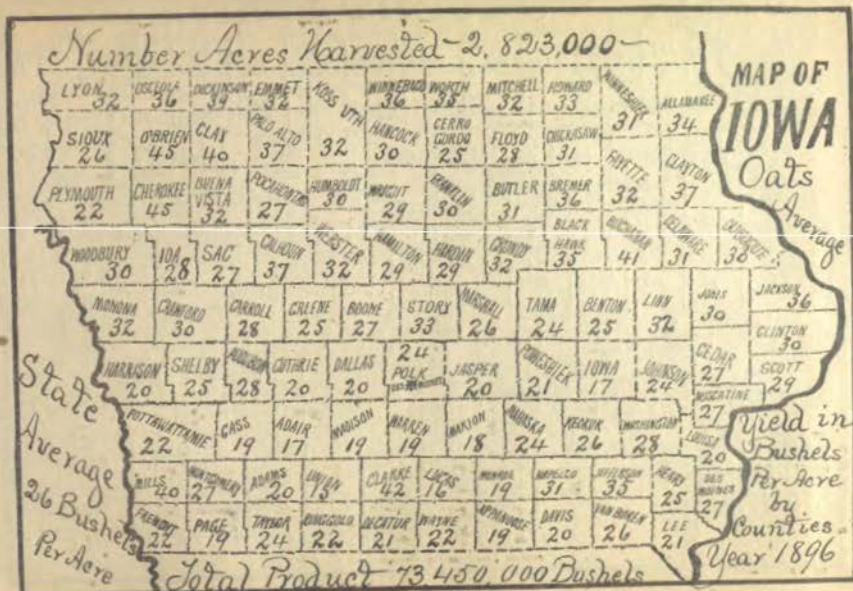
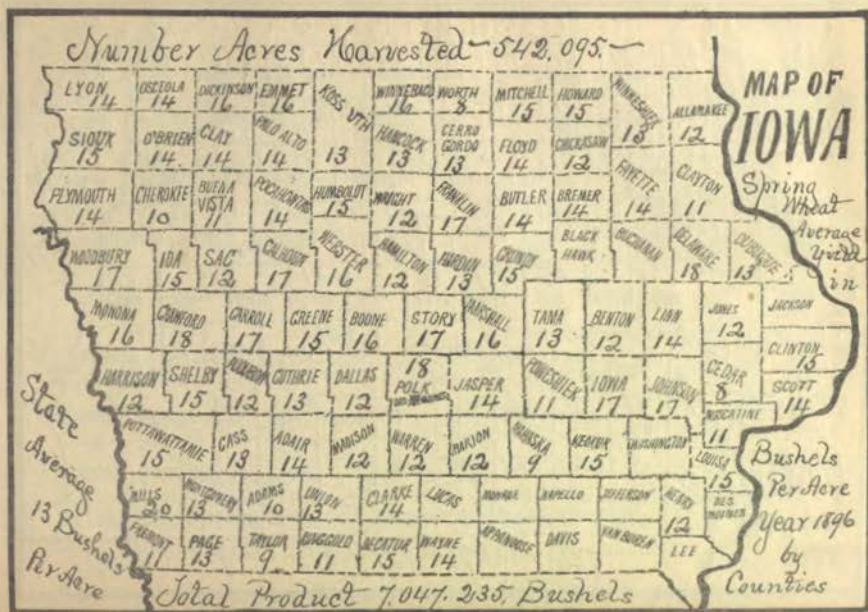
STATIONS.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.	No. of years.
Logan	1.30	1.39	2.06	3.23	4.46	5.84	5.41	3.82	3.37	5.61	1.21	1.13	35.51	16
McGregor	1.89	1.21	1.90	3.28	3.58	4.95	5.08	3.33	4.04	1.78	1.79	1.79	34.97	16
Monticello	1.57	1.75	2.27	3.27	4.62	5.91	4.47	4.59	3.60	5.77	1.77	1.77	35.79	13
Nassau	1.81	1.68	2.79	3.47	4.28	4.86	4.59	3.69	4.25	5.01	1.30	1.47	39.14	16
Nashua	1.54	1.33	1.76	3.07	4.19	5.38	5.28	3.68	3.87	5.53	1.45	1.31	34.64	16
Newton	1.63	1.25	1.75	3.07	4.19	5.38	5.28	3.68	3.87	5.53	1.45	1.31	34.64	16
Osage	1.61	1.64	2.43	3.72	4.72	4.48	5.86	2.81	3.52	5.65	1.60	1.60	31.57	10
Omaha	.67	1.13	1.55	2.71	4.31	5.61	5.15	3.43	3.36	5.30	1.39	1.21	33.06	19
Okaloosa	.94	1.13	1.55	2.71	4.31	5.61	5.15	3.43	3.36	5.30	1.39	1.21	33.06	19
Sac City	1.28	1.13	1.55	2.71	4.31	5.61	5.15	3.43	3.36	5.30	1.39	1.21	33.06	19
Smithland	.54	.65	.67	2.00	3.60	4.32	3.46	2.77	2.84	1.70	1.71	.67	24.43	9
Waterloo	1.15	1.24	1.49	2.00	3.58	3.66	4.51	3.71	4.01	1.40	1.40	1.40	35.79	12
Waukon	1.60	1.30	2.21	3.34	3.67	4.83	4.90	3.48	3.37	1.77	1.74	1.74	35.20	13
Wesley	1.14	1.03	1.42	2.30	3.30	4.74	3.60	2.79	3.83	3.17	1.13	2.10	29.60	10
Means	1.05	1.35	1.88	2.90	4.18	4.99	4.73	3.35	3.44	5.78	1.73	1.31	33.50	11

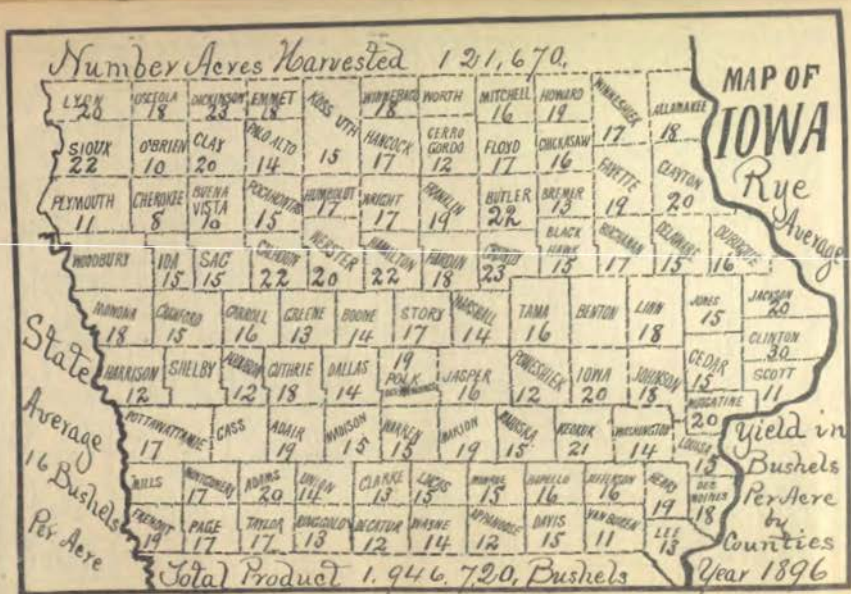
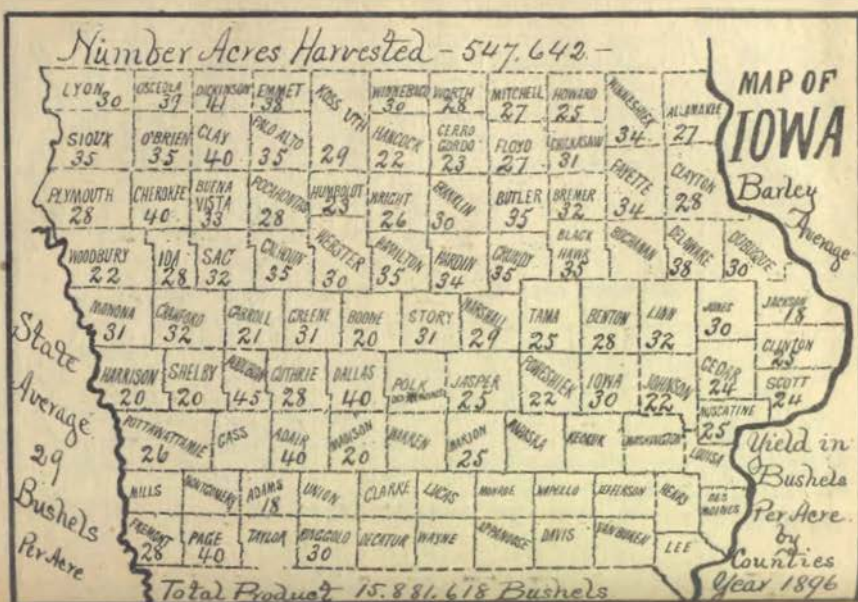
TEMPERATURE DATA.

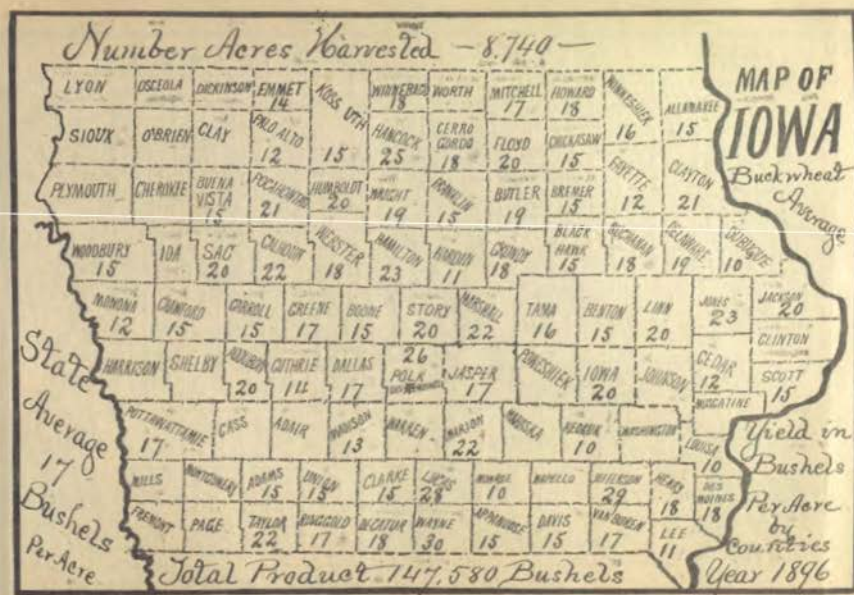
Mean Monthly and Annual Temperature at various Iowa stations, for the number of years named in the last column.

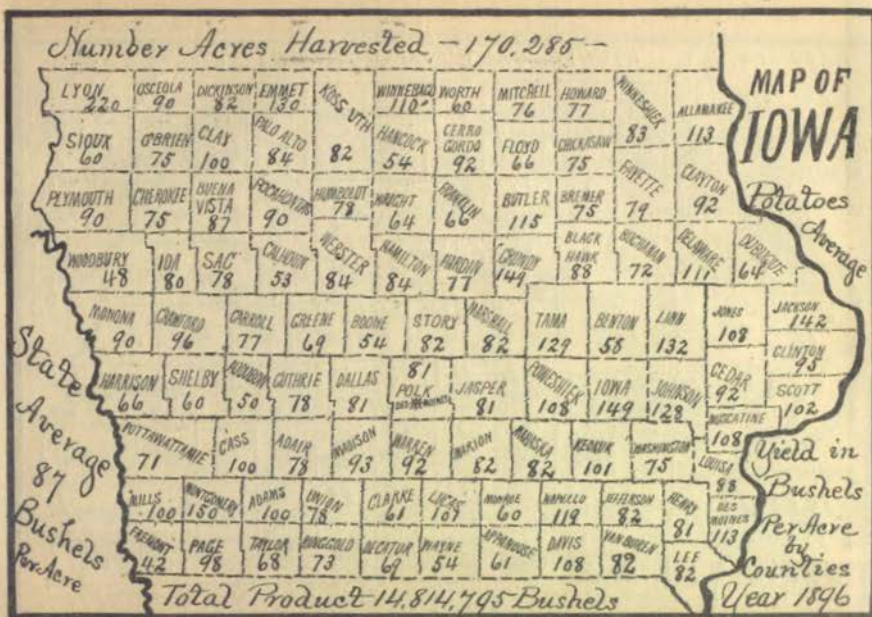
STATIONS.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.	No. of years.
Albion	11.6	17.3	25.1	35.7	45.8	58.4	66.9	70.9	69.9	59.6	49.1	39.7	41.8	6
Algona	10.7	15.3	25.1	35.7	45.8	58.4	66.9	73.3	70.9	59.6	49.1	39.7	41.8	6
Amama	13.3	19.2	30.7	40.8	50.9	63.5	73.6	76.3	76.3	61.4	50.7	40.8	45.9	9
Anna	13.3	19.2	30.7	40.8	50.9	63.5	73.6	76.3	76.3	61.4	50.7	40.8	45.9	9
Brookside	13.7	19.9	30.1	45.7	55.8	68.4	76.4	79.1	79.1	64.2	53.5	43.6	48.7	10
Cedar Rapids	15.3	21.3	32.4	43.2	53.9	70.6	78.6	81.6	81.6	62.6	49.4	34.4	47.9	19
Cresco	15.3	21.3	32.4	43.2	53.9	70.6	78.6	81.6	81.6	62.6	49.4	34.4	47.9	19
Clinton	15.3	21.3	32.4	43.2	53.9	70.6	78.6	81.6	81.6	62.6	49.4	34.4	47.9	19
Davenport	20.3	26.4	36.5	46.6	56.7	73.4	81.4	84.4	84.4	62.1	49.1	34.1	47.9	19
Dubuque	17.0	23.0	33.0	43.0	53.0	65.6	73.5	77.5	76.5	66.2	55.3	45.4	49.5	7
Dun Moines	17.0	23.0	33.0	43.0	53.0	65.6	73.5	77.5	76.5	66.2	55.3	45.4	49.5	7
Elkader	13.8	19.8	30.0	40.0	50.0	62.6	70.5	74.5	73.5	63.2	52.3	42.4	46.5	10
Fairfield	13.8	19.8	30.0	40.0	50.0	62.6	70.5	74.5	73.5	63.2	52.3	42.4	46.5	10
Ft. Madison	14.4	20.4	30.6	40.6	50.6	63.2	71.1	74.1	74.1	63.8	52.9	43.0	47.1	10
Garnaville	14.4	20.4	30.6	40.6	50.6	63.2	71.1	74.1	74.1	63.8	52.9	43.0	47.1	10
Glenwood	14.4	20.4	30.6	40.6	50.6	63.2	71.1	74.1	74.1	63.8	52.9	43.0	47.1	10
Guttenburg	13.9	19.9	30.2	40.2	50.2	62.8	70.7	74.7	73.7	63.4	52.5	42.6	46.7	10
Ida Grove	19.1	25.0	35.0	45.0	55.0	67.6	75.5	79.5	78.5	68.2	57.3	47.4	51.5	11
Independence	14.7	20.7	30.7	40.7	50.7	63.3	71.2	75.2	74.2	63.9	53.0	43.1	47.2	10
Iowa City	18.9	24.8	34.8	44.8	54.8	67.4	75.3	79.3	78.3	68.0	57.1	47.2	51.3	11
Kookab	18.9	24.8	34.8	44.8	54.8	67.4	75.3	79.3	78.3	68.0	57.1	47.2	51.3	11
Logan	18.9	24.8	34.8	44.8	54.8	67.4	75.3	79.3	78.3	68.0	57.1	47.2	51.3	11
Monticello	18.9	24.8	34.8	44.8	54.8	67.4	75.3	79.3	78.3	68.0	57.1	47.2	51.3	11
St. Vernon	17.1	23.0	33.0	43.0	53.0	65.6	73.5	77.5	76.5	66.2	55.3	45.4	49.5	7
Nashua	15.4	21.4	31.4	41.4	51.4	64.0	71.9	75.9	74.9	64.6	53.7	43.8	47.9	19
Newton	15.4	21.4	31.4	41.4	51.4	64.0	71.9	75.9	74.9	64.6	53.7	43.8	47.9	19
Osage	19.1	25.0	35.0	45.0	55.0	67.6	75.5	79.5	78.5	68.2	57.3	47.4	51.5	11
Orsha	14.6	20.6	30.6	40.6	50.6	63.2	71.1	74.1	74.1	63.9	53.0	43.1	47.2	10
Oskaloosa	19.1	25.0	35.0	45.0	55.0	67.6	75.5	79.5	78.5	68.2	57.3	47.4	51.5	11
Emtilda	14.6	20.6	30.6	40.6	50.6	63.2	71.1	74.1	74.1	63.9	53.0	43.1	47.2	10
Wintona	15.8	21.8	32.8	42.8	52.8	65.4	73.3	77.3	76.3	66.0	55.1	45.2	49.3	9
Wesley	15.1	21.1	31.1	41.1	51.1	63.7	71.6	75.6	74.6	64.3	53.4	43.5	47.6	10
Means	15.0	21.0	31.0	41.0	51.0	63.6	71.5	75.5	74.5	64.2	53.3	43.4	47.5	10

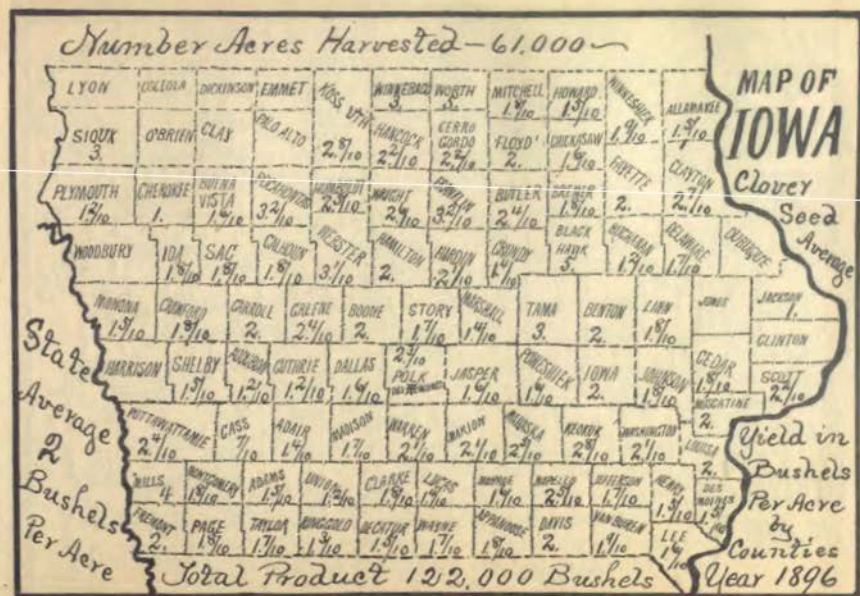
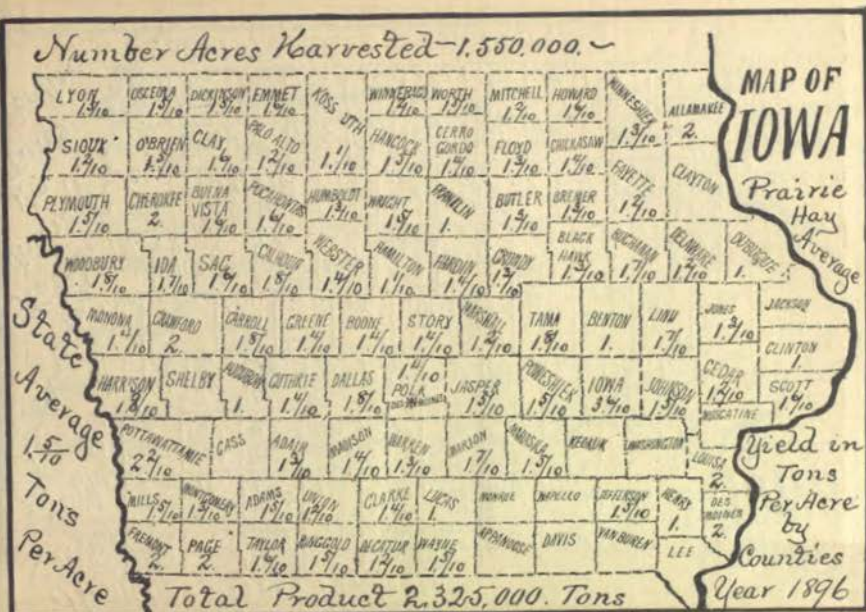


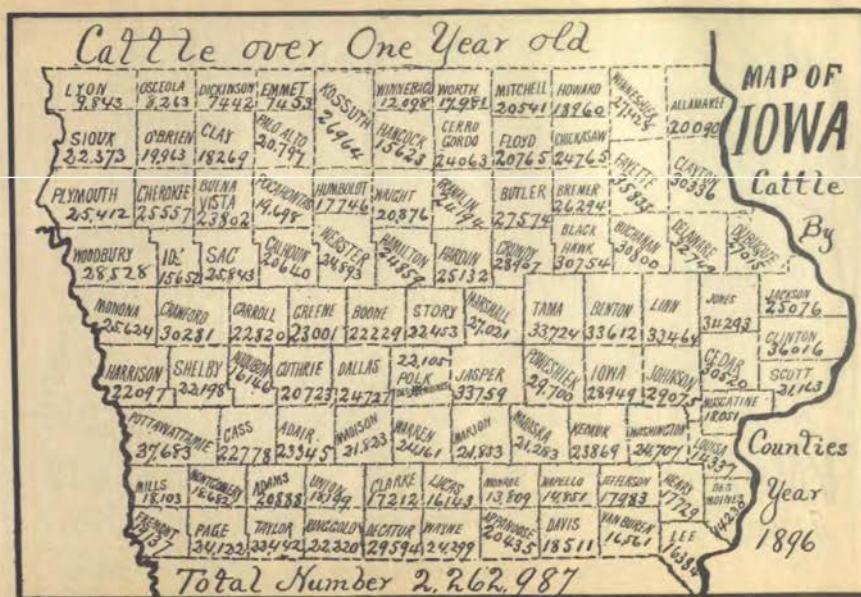
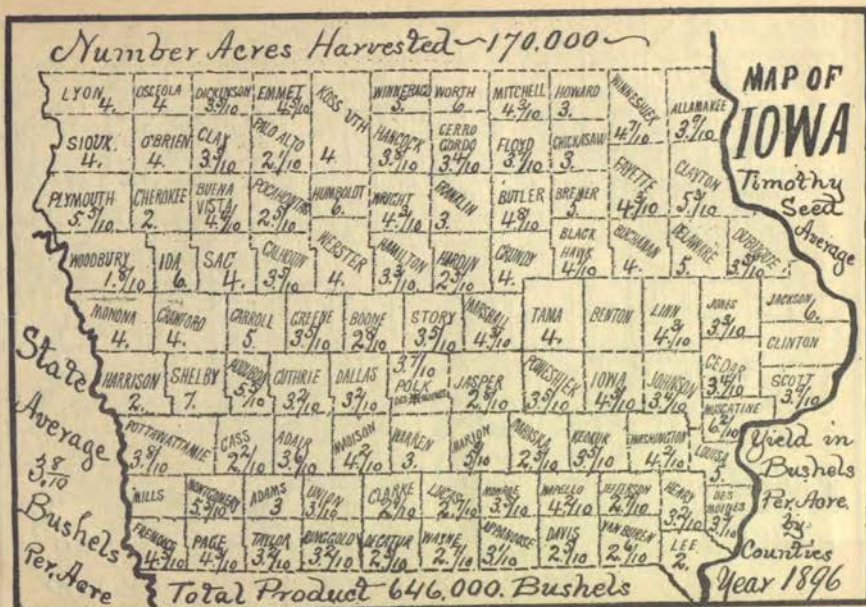












Horses over One Year old



Swine over Six Months old



