

or otherwise, shall, so long as she may choose, be and remain her separate estate and property, and may be devised, bequeathed, and conveyed the same by her as if she were a femme sole, and the same shall not be subject to the debts of her husband.

Sec. 8. The General Assembly shall provide for the time and mode of scheduling the separate personal property of married women.

Sec. 9. The homestead provided for in this article shall inure to the benefit of the minor children, under the exemptions herein provided, after the decease of parents.

II.—*The Drought of 1887, and some of its Effects on Irish Agriculture.* By Richard M. Barrington, M.A. LL.B.

[Read Tuesday, 3rd January, 1888.]

THE exceptional character of the summer of the year 1887, and its marked influence on the crops on my farm at Fassaroe, Bray, Co. Wicklow, induced me two months ago to make enquiries, and collect information from other parts of Ireland, for the sake of comparison. A circular with queries regarding the rainfall and crops was sent to a large number of observers on November 2nd. Their names were selected from the list of Irish contributors to *British Rainfall*, published by Mr. G. J. Symons, F.R.S., Secretary to the Royal Meteorological Society of London, whose annual volume is the standard work on the distribution of rain over the British Isles.

The information received was very interesting, and the favourable reception my paper on "The Prices of Some Agricultural Produce, and the Cost of Farm Labour for the Past Fifty Years," met with, encouraged me to arrange and tabulate the results, and bring them before the Statistical Society.

To say that the state of agriculture is of vital importance to Ireland is a truism, and that its periods of prosperity and depression fluctuate not only with prices but with produce is evident. The produce of the crops varies more than anything else with the character of the seasons. They are beyond human control, but are of far more importance to the farmer than the nature of his husbandry, which he can change into good or bad by care or negligence. Rain falls on the just and on the unjust, and the produce of the crops of both is influenced alike by the ever-fluctuating conditions of moisture and temperature.

The method intended to be followed in this paper is, first of all, to show you the extent and nature of the drought of 1887 in Ireland, and then take the different crops, one by one, and mention some of its effects on each.

What is a drought?

In the Khasia Hills, north-west of Calcutta, 30 inches of rain are recorded to have fallen in one day. That is to say, an amount equal to the annual rainfall in Dublin sometimes falls in this region in twenty-four hours. The average annual rainfall in the Khasia Hills is about 600 inches. If only 400 inches fell it would be a dry year there. Coming nearer home, the Styne, in Cumberland, is

the wettest part of the British Isles. The rainfall there is 170 to 200 inches annually, and 150 inches would be quite a moderate fall. The only Irish station at which an annual fall of over 100 inches has been recorded is at the Gap of Dunloe, where the Meteorological Office has a rain-gauge. Killarney lies about the centre of the rainy region in Ireland, as shown in the *Meteorological Atlas of the British Isles*, published in 1883 by the authority of the Meteorological Council.

There are regions on the globe where rain rarely or never falls. In parts of Peru a shower would be an event remembered for a generation. What then is a drought? A drought in one place would be a downpour in another, and *vice versa*. For the purpose of British Meteorology, Mr. G. J. Symons, F.R.S., the great authority on rainfall, has endeavoured to define a drought. In a paper read before the British Association at Manchester last year, he divides droughts into absolute droughts, partial droughts, and long droughts, thus:—

An absolute drought,	=	A period of 14 or more consecutive days absolutely without rain.
Partial drought,	=	A period of 28 or more consecutive days on which the total rainfall does not exceed .25 of an inch.
Long drought,	=	A period of not less than 60 days with a total rainfall of less than 2.00 inches.

None of these definitions give an accurate idea of what is meant by a drought in this paper. By a drought I mean such a deficiency from the average rainfall as materially affects agricultural produce. It may be said this definition is vague; but none of Mr. Symons' droughts come home to the farmer, because any one of them might occur in the year, without appreciably influencing the produce of his holding. What effect has the rainfall of November or December on the crops which are not only done growing, but have been long previously carted home to the farm-yard? This brings me to a point to which I wish to direct particular attention.

Relative importance of Winter and Summer months.

How often do we see writers on the "weather and the crops" arguing from the total rainfall of the year, or from the mean temperature of the year, and indulging in fanciful speculations as to the cause and effect of each on this crop and that crop! They reason as if every month of the year had an equal effect on vegetation. To them November is of equal value with June. It is obvious that this method of comparison is erroneous, and it is one of the causes which has prevented us from accurately grasping the complicated meteorological conditions which are associated with good harvests or bad harvests.

A heavy rainfall in January and February, or November and December, will often obliterate all traces of great drought in summer, if we look only at the total rainfall of the year. So also with temperature.

The influence of moisture and heat for the six months from April 1st to September 30th on agricultural produce is so much greater than the influence for the other six months, from October 1st to March 31st, that far more harm is done by including the winter months in calculations than by omitting them. If we include them, they vary the result much more than they should, and therefore a more accurate conclusion is arrived at by excluding them. If there is anything exceptional about the six winter months let it be mentioned, but let them be considered apart from the great growing season of the year. Omitting wheat, the great bulk of every crop in Ireland is sown after March 31st, and has arrived at perfection by October 1st. The bulk of the oat crop, if not sown after April 1st, is barely in the ground by that date. Barley is sown after April 1st. Potatoes are, for the most part, sown after April 1st. Turnips and mangolds are all sown after April 1st. Clover and grass seeds are sown after April 1st, the pasture grows little until after April 1st, and flax is all sown after April 1st. Therefore, with the single exception of wheat, the weather previous to April 1st has *comparatively* little to do with the crops, and the weather after October 1st has still less. I do not wish to ignore the effects of a wet or cold winter, or the influence of frost on the disintegration of the soil—of the difficulties and dangers of ploughing in wet weather, and of the washing away of nitrates into the subsoil, etc.—nor do I underestimate the advantage of a dry October if the harvest is late.* In 1887, October had little or no influence on the harvest, except in the case of indolent tenants who left the corn out in the fields, but this was due to laziness and not rainfall. As far as agricultural produce is concerned it is better to take the six months (April 1st to September 30th), and consider them separately. When this is done, any remarkable features of the winter months may be given; but in dealing with vegetation the meteorologist should concentrate his attention on the period from April 1st to September 30th. On the consumption of produce the winter months have a material influence, but not on the production.

The rainfall maps.

Having given some reasons to show why the six months April to September were selected, it may be well to explain how the statistics were collected from which the two rainfall maps which illustrate this paper were constructed.

About 115 circulars were sent out asking for the actual and average rainfall each month April 1st to September 30th, for five years—1882, '3, '4, '5, and '6—the rainfall for 1887, and the deficiency or excess in 1887 from the average of the previous five

* In the disastrous year 1879—the worst harvest of the century except 1816—(see Sir J. B. Laves' paper on "Our Climate and Our Wheat Crops, p. 17), a fine October saved the Irish harvest from complete ruin. The year 1879 was, however, from seed time to summer worse than 1816. It was the latest harvest at Fassaroe for 51 years. (See Table III. given in this paper at p. 231.)

years. Notes on the crops and the effect of the drought were also solicited.

Out of the 115 circulars, 72 complete rainfall returns were received—every county in Ireland being represented except three. (See Table I.) As to the crops, care must be always taken with local opinions, not to generalize from them, for every landlord or tenant is likely to judge of other people's crops by the condition of his own. The rainfall was not, however, a matter of opinion, but of fact. The opinions expressed by rainfall observers as to the state of agriculture are, however, not relied on in this paper. My intention is to state the facts as to the rainfall, and a few with regard to the temperature, and let others draw the conclusions. My own opinions are often expressed, not necessarily for acceptance, but rather for the sake of comparison with the views of others.

To have rainfall statistics which are strictly comparable one must have them made simultaneously and without a break for a given period, the same gauge being in the same position throughout, and it is well if the records are made by the same observer. To find a large number of stations which had complied with all these conditions, it was essential to take a comparatively short period, and I selected five years. The result has been satisfactory beyond my expectations.

The importance of having a gauge on the same position throughout is very great. It has long been ascertained that the higher a rain-gauge is placed above the level of the ground, the smaller the quantity of rain which is registered; and any movement of the gauge, if it be in the neighbourhood of houses, trees, or other obstacles, alters its relation to the currents of the atmosphere, and affects the quantity of rain registered.

These details are given to show that the data collected are fairly comparable, and I think it will be found that the maps showing the region of drought in Ireland are correct within all reasonable limits. The greatest reliance may be placed on observations which have been made by the same person with the same instrument, in the same position and with the same surroundings from beginning to end: the figures for one year are then strictly comparable with those of each succeeding year at the same station.

The Drought, April 1st to September 30th.

Tabulating the statistics, and calculating the averages, then entering the per-centage of rainfall which fell in the six selected months opposite each station on the map of Ireland, I found that these per-centages were grouped in certain well defined areas. (See Map No. I.)

First of all, the rainfall was everywhere under the average. At Markree observatory in Sligo there was 98 per cent. of the average rainfall; at Rosbercon Castle, County Kilkenny, it was as low as 41 per cent. These were the maximum and minimum per-centages—but speaking roughly, if you draw a line from Belfast to Miltown-Malbay, in Clare, every station to the W. and N. of that line got 80 per cent. or more of its average rainfall. Drawing another line from

Bantry to Drogheda, every station to the W. and N. of it got 60 per cent. or more of its average rainfall; and all stations to the S. and E. got less than 60 per cent. The driest areas of all were the S. E. of Kilkenny and a district surrounding the City of Cork. I am now speaking of the rainfall from April 1st to September 30th. The map (No. I.) showing its distribution will more clearly exhibit the actual boundaries of the various areas. It is coloured from dark green to pale green—the dark region being supposed to have a comparatively luxuriant vegetation, and the pale green representing the district which suffered most from the drought.

The Drought, April 1st to June 30th.

Knowing the great importance of the months April, May, and June to farmers, I examined this period separately, and mapped it out on the same principles, the same colours representing the same per-centages on both maps. (See map No. II.) In some respects the result was very different; but we still have the region of greatest drought confined to the S. and S. E. of Ireland, but the deficiency of rainfall is far greater than in the six months' period taken as a whole. In April, May, and June the extreme N. of Ireland felt the drought least—as much as 93 per cent of the average rainfall being recorded from N. Antrim; whereas Courtown, in Wexford, and the S. E. of Kilkenny and part of Cork, had less than 30 per cent. In April, May, and June the 80 per cent line only cut off the northern parts of Donegal, Londonderry, and Antrim. A line drawn from Belfast to Achill would almost coincide with the 60 per cent. line. Generally speaking, all places to the south of this line felt the drought severely in April, May, and June. There was a local drought of much severity extending from Warrenpoint, in Down, to Dundalk. Part of Dublin, East Wicklow, Wexford, South Kilkenny, Waterford, and South Cork were affected in a manner which will make persons of the present generation long remember the summer of 1887.

Actual and relative rainfall.

The maps would have been quite different if the figures represented the *actual* rainfall at each place. For example, 16 inches of rain fell at Valencia in six months, and about 10½ inches at Parsonstown; yet Valencia was the drier place of the two. It may be asked how can one place be drier than another if more rain fell on the dry place? In this paper a place is understood to be wet or dry according as it has more or less rain compared with the normal quantity at that place. From an agricultural point of view, this is the true method of comparison. A farmer sows his crops with expectations as to moisture and temperature based on his past experience of the weather, and the variation in the climate each year from the normal condition is the measure of his disappointment. A Kerry man will tell you he never remembered such a dry season; but give the County Dublin farmer the same quantity of rain, and he will assure you all his crops are ruined. It is all a question of ex-

pectation, and the percentages on the maps may be termed "coefficients of disappointment" if you like. They are, however, to be taken in inverse ratio, because the smaller the percentage the greater the disappointment.*

It will be noticed that on both maps the areas of comparatively heavy rain and great drought came closest together in the Counties Armagh and Down, and the transition from green fields to those which were burnt brown was most rapid in this part of Ireland.

The Drought generally.

It is not my intention in this paper to do more than mention the drought in England and Scotland. Everywhere in the British Isles the rainfall was deficient, except in the extreme north of Scotland. We know also that there was a drought over the north of France, and that the Danube was extraordinary low in the autumn; but how far the deficiency of rainfall extended over Europe has not yet been ascertained. In Norway and Sweden it is stated that there was a considerable excess of rainfall. Parts of North America, on the other hand, suffered from a drought of exceptional severity.

"The subtle influence which determines whether a season shall be wet or dry, hot or cold, is at present a profound mystery; but that something of the kind exists is abundantly evident to all who have endeavoured to work out the causes of our seasonal weather changes."—*"The Recent Drought,"* by Frederick J. Brodie, *Nature*, August 25th, 1887.

It is unnecessary to enter into the conditions of barometric pressure under which the drought occurred; those who have the inclination can study them in the charts issued daily by the Meteorological Office, London. But, as might be expected, the conditions over the British Isles were, during continuance of the dry spell, anti-cyclonic.

From the table opposite (prepared to show the character of the year 1887 as a whole) it will be seen that January was about an average as to rainfall and temperature, the number of rainy days being slightly below the average. February was very dry, and slightly colder than usual. March had a deficient rainfall, and was decidedly cold. April was very dry, and the coldest April since 1860, with the exception of April, 1879. May was dry, and rather cold. Then came a great change. On Sunday, June 5th, the temperature rose, and for the remainder of the month we had a combination of heat and drought, which lasted until July 10th. No record exists of such a hot and dry June in the south and south-east of Ireland. For thirty-four consecutive days a blazing sun shone like a fire-ball in a cloudless sky. Not a drop of rain fell, except a sprinkle on one day. It was at the period of the year when the nights were shortest, and the sun was at its maximum altitude; there was little dew. After the cold, dry spring, vegetation was backward, and all thought it would be a late harvest. The

* Disappointment is not applicable to marshy or "bottom land" this year, for the farmers there rejoiced in the dry warm summer.

TABLE II.

Months.	FASSAROE, BRAY.						FITZWILLIAM SQUARE, DUBLIN.*		
	Average Rainfall in inches for 30 years.	Rainfall in inches in 1887.	Excess or Deficiency 1887.	Average number of rainy days for 30 years.	Rainy days, 1887,	Excess or Deficiency, 1887.	Average Mean Temperature for 22 years.	Mean Temperature, 1887.	Excess or Deficiency.
January,	4.142	3.945	— .197	18.1	17	— 1.1	41.4	41.5	+ 0.1
February,	3.995	1.205	— 2.790	15.7	9	— 6.7	43.2	42.9	— 0.3
March,	3.545	2.420	— 1.125	16.2	16	— .2	43.5	41.3	— 2.2
April,	3.071	1.520	— 1.551	13.7	9	— 4.7	48.1	45.1	— 3.0
May,	2.582	1.760	— .822	14.0	13	— 1.0	52.1	51.8	— 0.3
June,	2.742	.285	— 2.457	13.6	4	— 9.6	57.7	62.3	+ 4.6
July,	2.539	1.480	— 1.059	14.6	12	— 2.6	60.7	63.7	+ 3.0
August,	3.046	4.230	+ 1.184	14.6	12	— 2.6	59.9	60.3	+ 0.4
September,	3.306	1.795	— 1.511	15.1	14	— 1.1	56.0	54.0	— 2.0
October,	4.705	2.640	— 2.065	18.0	10	— 8.0	50.0	47.3	— 2.7
November,	3.800	5.565	+ 1.765	16.3	21	+ 4.7	44.4	42.6	— 1.8
December,	3.948	2.530	— 1.418	16.6	19	+ 2.4	41.3	39.9	— 1.4
Total,	41.331	29.375	— 11.956	186.4	156	— 30.4	49.85	49.39	— .46

Ten months of deficient rainfall; two above the average rainfall.

Ten months with fewer rainy days than usual; two with rainy days above average.

Eight months colder than usual; four warmer.

* Dr. J. W. MOORE, F.R. Met. Soc., 40 Fitzwilliam-square, W., has kindly furnished the records of temperature, the Fassaroe mean temperatures not having been worked out in time.

ground was parched at the commencement, and the herbage stunted by cold wind. Then came the period of fierce heat, and the sun played on the pastures, the corn, and the young turnips; the grass was burnt brown; the corn, stimulated by high temperature and sunshine, shot prematurely into ear, at a height of six inches, and, though the harvest was expected to be late on June 1st, the fields were turning yellow in the second week in July. The succulent and tender young turnips were shrivelled and scorched, and if a few survived, they quickly succumbed to the fly and the *Aphis*, or plant louse.

The opposite table (No. III.) shows that the harvest of 1887 was the earliest but one for half a-century.

As a farmer, I can recall no such sudden change of a similar character at the great growing period of the year; and as a meteorologist, I have seen no record of any. July was also very hot, but not so remarkable as June for its high mean temperature or small rainfall. There is no recent instance of the mean temperature of June and July, taken together, being so much above the average, and probably no instance can be shown of such a hot and dry June and July following such a cold and dry spring.

The following table shows the rainfall and temperature of June for twenty-three years at Fassaroe:—

TABLE IV.—SHOWING THE RAINFALL AND TEMPERATURE OF JUNE, AT FASSAROE, SINCE 1864.

Year.	Average Temperature at 9 a.m.	Rainfall in Inches.	Year.	Average Temperature at 9 a.m.	Rainfall in Inches.	Year.	Average Temperature at 9 a.m.	Rainfall in Inches.
1864	58.04	1.63	1872	57.52	3.25	1880	57.63	3.02
1865	64.80	0.70	1873	60.66	1.04	1881	57.67	4.51
1866	59.43	5.31	1874	60.77	0.89	1882	56.53	2.53
1867	60.23	0.80	1875	58.48	2.47	1883	57.57	3.38
1868	62.34	1.43	1876	59.68	1.42	1884	60.97	1.18
1869	58.00	1.25	1877	60.60	1.65	1885	58.20	2.16
1870	61.33	0.48	1878	59.50	4.60	1886	60.89	1.75
1871	58.76	3.08	1879	56.95	7.23	1887	65.41	0.28

Dr. J. W. Moore, F.R. Met. S., of Fitzwilliam-square, our best authority on Irish meteorology, states that for the past twenty-two years there has only once been as hot a July in Dublin, *i.e.*, July, 1868. In 1868 the harvest was the earliest on record.

Having examined the weekly weather reports for the British Islands,* and added the excesses and deficiencies of mean temperature for each district during June and July, 1887, I find the following figures:—(see page 232.)

* Issued by Meteorological Office, 116 Victoria-street, London.

TABLE III.—SHOWING THE DATE AT WHICH THE HARVEST COMMENCED AT FASSAROE, BRAY, FOR FIFTY-ONE YEARS.

Year.	Wheat.	Oats.	Barley.	Earliest.	
1837	Sept. 2	Aug. 25	Aug. 26	Aug. 25	Oats
1838	" 10	Sept. 6	" 23	" 23	Barley
1839	" 2	none	Sept. 6	Sept. 2	Wheat
1840	" 4	Sept. 1	Aug. 23	Aug. 23	Barley
1841	Aug. 31	" 6	" 19	" 19	Barley
1842	" 15	Aug. 23	" 13	" 13	Barley
1843	" 25	Sept. 11	" 26	" 25	Wheat
1844	" 10	Aug. 12	" 13	" 10	"
1845	Sept. 1	Sept. 2	" 28	" 28	Barley
1846	Aug. 12	Aug. 11	" 18	" 11	Oats
1847	" 20	" 13	" 25	" 13	"
1848	" 19	" 10	" 24	" 10	"
1849	" 20	" 14	" 17	" 14	"
1850	" 23	" 13	" 22	" 13	"
1851	" 28	" 21	" 16	" 16	Barley
1852	" 30	" 20	" 12	" 12	"
1853	Sept. 2	" 24	" 29	" 24	Oats
1854	Aug. 25	" 21	Sept. 1	" 21	"
1855	" 13	" 18	Aug. 14	" 13	Wheat
1856	" 16	" 12	" 22	" 12	Oats
1857	" 14	" 6	" 19	" 6	"
1858	" 11	" 18	" 24	" 11	Wheat
1859	Aug. 1	Aug. 2	Aug. 12	Aug. 1	"
1860	Sept. 5	" 31	" 29	" 29	Barley
1861	Aug. 17	" 8	" 22	" 8	Oats
1862	Sept. 1	" 26	Sept. 5	" 26	"
1863	Aug. 11	" 12	Aug. 10	" 10	Barley
1864	" 5	" 12	" 11	" 5	Wheat
1865	" 16	" 11	" 20	" 11	Oats
1866	" 16	" 20	" 9	" 9	Barley
1867	" 21	" 23	Sept. 4	" 21	Wheat
1868	July 29	July 23	July 29	July 23	Oats
1869	Aug. 20	Aug. 10	Aug. 14	Aug. 10	"
1870	" 4	" 2	" 9	" 2	"
1871	" 22	" 16	" 19	" 16	"
1872	" 25	" 19	" 26	" 19	"
1873	" 20	" 8	none	" 8	"
1874	" 10	" 1	none	" 1	"
1875	" 20	" 16	Aug. 21	" 16	"
1876	" 18	" 8	" 14	" 8	"
1877	" 30	" 28	Sept. 4	" 28	"
1878	" 13	" 12	Aug. 22	" 12	"
1879	Sept. 18	Sept. 10	Sept. 1	Sept. 1	Barley
1880	Aug. 27	Aug. 13	none	Aug. 13	Oats
1881	Sept. 1	" 18	Aug. 23	" 18	"
1882	" 4	" 17	Sept. 12	" 17	"
1883	" 14	" 27	Aug. 31	" 27	"
1884	Aug. 22	" 13	" 29	" 13	"
1885	" 29	" 25	" 29	" 25	"
1886	Sept. 9	" 23	Sept. 6	" 23	"
1887	Aug. 11	July 25	July 26	July 25	"

Average date for commencing harvest, August 15th to 16th.

Latest harvest, 1879; earliest, 1868. Wheat reaped first, 8 times; Barley 11 times; and Oats, 32 times.

		Accumulated excesses minus deficiencies in degrees.
Ireland, S.	...	24
" N.	...	22
Scotland, E.	...	22
England, N. E.	...	17
Channel Islands,	...	17
Scotland, W.	...	16
England, N. W.	...	15
" S. W.	...	15
" Midlands,	...	14
" S.	...	11
" E.	...	8
Scotland, N.	...	8

If these figures be divided by 9, for the nine weeks from May 30th to August 1st, the excess over the mean temperature will be found in degrees for each district. But they show the excess of heat above the average more clearly as they stand. The S. of Ireland heads the list, and suffered most from heat; then the N. of Ireland and E. of Scotland are equal. At the bottom we find the E. of England and the N. of Scotland.

As to rainfall over the British Isles, June was one of the driest ever experienced. It has been said that there was no rain from sowing until reaping in 1826, and it is still remembered by some farmers as "the year of the short oats." In Clare, 1826 is said to be called by country people "the summer of the meal." I have been unable to procure any authentic record for 1826 in Ireland.*

In the E. and S. of Ireland, up to August, every month of 1887 was drier than usual, especially June; but rain came on August 13th, and the remainder of that month proved moderately wet. Had August been dry, the S. and S. E. of Ireland would have been, agriculturally speaking, ruined. The wet August saved the pastures and the root crops. Its temperature was about the average. September was dry and cold. October was dry and very cold. November was wet and cold. Of the twelve months of 1887, eight were colder than usual two about an average, and two of fierce heat. Ten months were drier than usual, and two had an excess of rainfall. The *striking feature of the year* was the sudden outburst of heat in June and July, accompanied by great drought, and following a very cold, dry, backward spring. Taking the six months, April to September inclusive, they were drier in 1884; but in 1884 we had ten inches of rainfall in the preceding February, whereas there was little over an inch in 1887, and in 1884 there was none of the extraordinary heat experienced in 1887. There was also less rain in these six months in 1870. But perhaps the nearest approach to the present year was 1864; it was much drier from April to September, but June and July were not nearly so warm as 1887.

* Since writing the above, Mr. G. J. Symons has forwarded to me a return for 1826 from the Linen Hall, Belfast. The total rainfall was 30.40 inches there. Only .70 fell in May, and .46 in June, and 1.95 in July. Probably the deficient rainfall was accompanied by great heat.

TABLE V.—SHOWING THE RAINFALL AT FASSAROE FOR EACH QUARTER OF THE YEAR, FOR THIRTY YEARS, 1858-1887.*

Year.	Jan. Feb. March.	April, May, June.	July, Aug. Sept.	Oct. Nov. Dec.	Total.	Year.	Jan. Feb. March.	April, May, June.	July, Aug. Sept.	Oct. Nov. Dec.	Total.	Year.	Jan. Feb. March.	April, May, June.	July, Aug. Sept.	Oct. Nov. Dec.	Total.
1858	6.88	13.71	9.33	10.76	40.68	1868	9.12	5.47	12.53	14.59	41.71	1878	5.59	14.64	8.23	8.31	36.77
1859	9.15	9.07	9.14	12.20	39.56	1869	12.41	11.22	6.24	9.09	38.96	1879	12.61	12.94	10.97	5.56	42.08
1860	14.87	13.96	11.47	16.73	57.03	1870	10.71	3.40	5.29	13.73	33.13	1880	10.32	6.66	10.96	16.72	44.66
1861	20.73	5.33	14.26	11.04	51.36	1871	9.49	6.87	9.81	7.08	33.25	1881	11.82	8.48	9.47	14.77	44.54
1862	14.13	10.26	8.77	12.63	45.79	1872	12.82	8.98	8.31	20.39	50.50	1882	9.84	11.11	10.79	17.04	48.78
1863	9.80	4.14	6.84	14.93	35.71	1873	8.96	2.41	9.77	6.60	27.74	1883	18.59	10.39	13.14	9.26	51.38
1864	8.43	3.47	3.79	15.96	31.65	1874	7.46	4.17	7.97	11.88	31.48	1884	18.97	5.50	5.35	6.99	36.81
1865	10.15	7.46	8.97	15.63	42.21	1875	9.84	5.18	10.11	16.25	41.38	1885	13.33	10.39	9.48	9.97	43.17
1866	12.50	9.67	7.63	8.41	38.21	1876	8.61	4.55	9.04	23.40	45.60	1886	11.95	11.27	6.90	19.07	49.19
1867	14.05	8.62	6.42	6.18	35.27	1877	12.30	10.80	10.50	10.90	44.50	1887	7.57	3.56	7.50	10.73	29.37

* In April, 1878, the rainfall was taken from the records of a gauge placed about 50 yards S.W. of the old gauge, but similar in other respects. Experiments continued for one year proved that this instrument registered .093 per cent. (or slightly less than one-tenth) more than the old gauge, and the figures from April, 1878, to the present have to be corrected accordingly, in order to be strictly comparable.

It has been shown that in June and July, 1887, the S. of Ireland suffered more from excess of heat than any part of England or Scotland; but the weekly weather reports show that the N. and S.W. of England suffered far more than the S. of Ireland from want of rain. The drought in the S.W. of England was something extraordinary, and the deficiency of rain there in June and July bears the proportion of 38 to 28 in S. of Ireland. A brilliant sun and high temperature are, however, capable of quickly drying up moisture, and in this respect Ireland was worse off than the S.W. of England. The combination of drought and heat was probably more severely felt in Ireland than any part of the British Isles. The word "probably" is used, because it is difficult to ascertain exactly what diminution in rainfall is equivalent to a given excess of heat.

Having now given the meteorological conditions of the year 1887 in some detail, and explained the rainfall maps which I have prepared to illustrate this paper, let us see how the crops in Ireland were influenced by the exceptional season we have just gone through.

Wheat.

The map on the wall* shows the distribution of this crop in Ireland in 1886. Every black dot represents 1,000 statute acres. Observe the small quantity grown in Ireland. Compare the wheat map with the two maps showing the distribution of oats and barley, which have been made on the same principle. There are only 70 dots on the wheat map, compared with 182 on the barley map. and 1,322 on the oat map.

Observe also the distribution of the wheat crop. The County Down continues to be one of the great wheat growing counties in Ireland. Other counties at one time held the premier place, but Down is now the only county growing more than 10,000 acres; the other counties having more than 3,000 acres are Cork, Kilkenny, Tipperary, Wexford, and Armagh. Fifty years ago there was eleven times as much wheat grown in Ireland as there is now, and the value of the crop has decreased in a still greater proportion.

Comparing the maps showing region of severe drought, and the map showing the distribution of the wheat crop, it will be seen that the great bulk of the wheat crop was grown within the region of severe drought. Sir John B. Lawes, F.R.S., states in his excellent paper on *Our Climate and our Wheat Crops*, that :

"It would appear that the defect of our climate for the production of wheat is more connected with an excess of moisture than with a deficiency of heat during the periods of active growth and maturing. It is when a cold season, or one of only moderate temperature, is accompanied by an excess of rain, that we find the yield of our wheat crops is most defective."

The dry spring of 1887, and the warm dry summer, were admirably

* Several large maps of Ireland were prepared to show the distribution of the various crops, as well as of sheep and cattle.

suites for the growth of wheat. Wheat is the only crop which is much affected by the last quarter of the previous year. If it is sown early, and the ground is saturated, and a cold spring follows—the young plants often die, or the grain rots in the ground. This was the case at Fassaroe in 1887; and in April it was suggested to plough up the wheat field and sow barley; but fortunately this was not carried out, and the dry, warm June and July afterwards made an average crop of it, and the grain was full and plump. There is little to grumble at except the price—19s. per barrel, against 30s. per barrel, the average of 40 years ending 1876. Wheat in this country requires good ground and capital to grow it. It takes more out of the soil than oats or barley, and therefore, more capital must be sunk in the soil, by heavily manuring the previous green crop, if a good yield is to be expected. Wheat is a very weedy crop, if thin; because, being sown so early, the weeds have a longer time to mature; they are strong when the wheat shoots into ear, and are not so easily smothered by the straw; most of them ripen before harvest, and the mischief is complete at reaping time. The heat this year had a most stimulating effect on weeds among corn, and judging by the number of species which ripened their seeds, next year promises to be a troublesome one.

Oats and barley are better crops to grow when cleaning dirty ground, provided the soil is not too stiff. The surface of the land is undisturbed for a shorter period, and the straws of oats and barley generally grow closer together, and kill the weeds. Whether the drought in England had any influence on the spread of the small dipterous fly (*Cecidomyia destructor*, Say)—commonly called the Hessian fly—I know not; but great attention was directed to it there. At the request of the Lords of the Committee of Council for Agriculture, Mr. Charles Whitehead, F.L.S., prepared a paper in 1886, for the information of agriculturists, and Miss Ormerod, the consulting entomologist to the Royal Agricultural Society of England, writes to me that her report for 1887 on the Hessian fly in Great Britain is in the press, and will shortly appear. It was first noticed in England in 1886, but has not yet been detected in Ireland. The larva of this fly is terribly destructive to corn crops in America, Canada, and parts of Germany. It attacks the straw about the second joint from the ground, and the weakened stem, being unable to bear the weight of the ear, bends down above the point of injury. It has never been known to attack oats, so that if it should reach Ireland, the principal cereal will be safe.

Returning to the wheat crop. The spring of 1887 was favourable for sowing wheat, and the summer was favourable for ripening it; and if we except that portion of the crop sown in wet quarter of 1886, the yield of 1887 should be quite up to the average, if not above it. Most of the reports I have received show it to have been above the average. It may seem idle for one individual to speculate on the yield of the crops in Ireland, when we will shortly have the statistics of produce issued by the Registrar-General, compiled from the returns of the enumerators, selected by the District Inspectors of the Royal Irish Constabulary. But when we have some of the at-

mospheric conditions which produced the crops before us, one may be pardoned offering suggestions as to their effect.

As the produce returns have been referred to, it may be no harm to observe how necessary it is to have the same class of enumerators acting on identical instructions every year. Not only this, but the crops should be grown on the same class of land. If any one of these conditions vary you will have a different result, and only an approximation of an approximation can be arrived at when *comparing* one year with another. A farmer can usually tell the number of cattle he possesses, he can state the acreage of his farm; but the estimate of his produce per acre is a figure often given with questionable accuracy, and it is still more difficult for a stranger to arrive at it. Therefore this particular class of information in the agricultural returns is peculiarly liable to error—especially if the enumerators are changed or their instructions varied.

Dr. Hancock says:—

“The estimates of produce were made differently before 1855 and after 1856. I have therefore distinguished the two series of years. In the earlier periods the produce was estimated by the sub-inspectors of constabulary, in the sub-inspector’s district, in November in each year. Since 1855 the produce is estimated by the constabulary in January or February, after each crop, in poor-law electoral divisions, and corrected according to opinions of poor-law guardians. In 1855 the opinion of the poor-law guardians was to some extent used in checking the returns of the constabulary; in 1856 both systems were used. The tendency of taking the opinion of the guardians has been to lower the rates of produce.”—*Report on the Supposed Progressive Decline of Irish Prosperity*, presented to the Lord Lieutenant, March 27th, 1863.

Tillage has decreased enormously; the acreage under almost every crop has contracted; and while this process was going on, the land which gives the best crops would be the last under cultivation, because it pays best to till it. The produce per acre off a small area of good land would be higher than that off a large area of good and bad land, and therefore the agricultural returns should show a higher yield per acre than formerly, all other things being the same.

Within the limits of this paper it is impossible to enter fully into the question. I have mentioned it because, looking back over a long series of years, I have often found a difficulty in connecting the meteorological conditions of certain years with the produce of the various crops as given in the agricultural returns, and for the same reason it is not easy to arrive at any satisfactory conclusion as to whether the producing powers of land under tillage in Ireland has deteriorated or not.

Barley.

If we except the County Louth, this crop is almost entirely confined to the S. and S. E. of Ireland, and to the midland counties E. of the Shannon and S. of Westmeath. The map on the wall shows the distribution of this crop more clearly. It is almost entirely included in the region of drought—Wexford, the great barley county of Ireland, having had an extremely deficient rainfall. Any farmer

who sowed his barley late with the ground in bad order had not half a crop this year. I saw many barley fields in Kilkenny not worth reaping. Those who sowed early and had the ground in fine order had a fair crop. Lumpy soil is bad at all times, but with barley in a dry season it practically means a failure. The finer the soil is pulverized the longer it will retain its moisture, and the more easily the tender rootlets will work their way through it. Open cracked land permits a constant circulation of air a considerable depth below the surface. This dry air in a hot season will quickly abstract the moisture from the soil, and leave little for the growth of plants, especially annuals, whose roots are neither far-reaching nor deep. On the whole, the barley crop is much below the average this year, and a failure in some districts. It cannot be otherwise, having regard to the season; the grain had hardly time to fill, and the straw is short. Looking at Table No. III., showing the date of reaping at Fassaroe for 51 years, it will be seen that 1887 was the earliest barley harvest on record, not excepting 1868. The grain was saved in excellent condition—a great contrast to last year, when the quantity of damaged barley was enormous, few good samples being procurable, and large quantities were sold for grinding, at prices varying from 7s. to 10s. per barrel. In 1886 the harvest was late, and whenever this happens a wet October brings sprouting grains and discoloured samples. A late harvest means cutting the corn before it is ripe, for once the usual time for reaping is past there is always a tendency to begin too soon. When this is done, the corn and straw take more than twice as long to dry. The days are shorter, the temperature lower, and the atmosphere is nearer the point of saturation. All these conditions combine to prevent the grain and straw drying; the stooks are left out week after week, and if October proves rainy, the ruin of the unsaved harvest is completed. In Ireland a moderately early harvest should always be a source of congratulation. Within the past few years large quantities of Swedish and other foreign barley have been imported into Dublin. Were it not for this, prices would not be so unlike old times.

Oats.

This is far the most important cereal cultivated in Ireland, the acreage under oats—1,322,000 acres—being more than five times as much as barley and wheat put together. The proportion of oats consumed by the farmers themselves is, however, far more in the case of oats than in the case of either wheat or barley. This must be borne in mind when calculating the effect of a fall in prices. The moist insular climate of Ireland is better suited for oats than either wheat or barley. Drought is injurious to it, and the crop of 1887 suffered severely. Looking at the map showing the distribution of the oat crop, one is at once struck by its uniformity compared with wheat or barley. In the N. W. oats suffered least; in the S. and S. E. its yield was greatly diminished, and the straw was so short in many places that reaping machines could not be used, and it had to be either mown and raked up, or pulled by the hand. The grain also,

though white, is thin and slender, and wants the plump kernel inside which is produced in a favourable year. When thrashing, a much larger proportion than usual comes out with the tailings. In the region of drought the produce of the oat crop was far below the average. When the oat straw is short I have noticed a tendency to underestimate the yield before thrashing. Of a dry season the stack or rick looks small, and it is assumed that the produce of grain is proportionally diminished. This not always the case; therefore the enumerators in a dry season are not likely to over-estimate the produce. The price of oats was very low in Dublin about two months ago, notwithstanding the deficiency this year. I attribute this in some measure to the early harvest. The bulk was small and it was saved quickly. Farmers had plenty of time on their hands, and a larger number than usual commenced thrashing out at the same time. This glutted the market. Oats have since risen.

The combination of heat and drought, which proved disastrous to most, greatly benefited a few. The difference between the produce on boggy soil and that on naturally dry ground has rarely been so marked before. Marshy districts, damp pastures on the mountain sides, and low meadows subject to floods, had a favourable year, as far as produce is concerned. In parts of the W. and N. W. there is little to grumble at except prices. Taking the cereals as a whole, wheat is good; barley has suffered severely—the straw is short, and the yield under the average; oats suffered terribly, except in the N. W. and extreme N.; the straw is very short, and the grain light and thin.

Flax.

The distribution of Flax in Ireland is very striking—it is pretty evenly spread all over Ulster; but in no single county outside of Ulster is there 1,000 acres of flax grown. There were 130,200 acres grown in 1887, against 89,200 acres in 1884—the year of the smallest extent since 1849. Considering its acreage, the flax crop has varied greatly. It reached its maximum in 1864 with 301,000 acres. Between 1864 and 1871 £17,000 was granted by the government to promote its cultivation in the S. and S. W. of Ireland. The map shows how unsuccessful the attempt has proved. Flax is usually sown in April, and pulled in July. June is a most important month for flax; and though the N. of Ireland was least affected by the drought, the accounts of the flax crop are not encouraging. Out of 81 reports sent to the *Irish Farmer's Gazette* in August, 65 were under the average, 15 average, and only 1, from Letterkenny, was over the average.

Meadow, Clover, Pasture, and Waste Land.

Meadow and clover has always been included in the “total extent under crops” in the agricultural statistics. It is also separately given, but in order to find the real diminution of land which has been withdrawn from tillage—a process of subtraction has to be gone through,

and the extent under "meadow and clover" deducted from the "total extent under crops." Meadow and clover is no doubt a crop—it is now one of the most important in Ireland, but it differs from all others in the method of its cultivation. The great bulk of it is the produce of perennial grasses. The soil has not to be annually ploughed, and there is no fresh sowing every year, unless in the case of a strict rotation, and even then it is often left unbroken for two or three years. Although wheat has decreased 678,000 acres, barley 121,000 acres, oats 884,000, acres, and turnips 70,000, since 1847, meadow and clover has increased 1,004,000 acres. It is the only important crop in Ireland which has increased its acreage. For potatoes the year 1847 is not a fair starting point; seed was then scarce, and farmers were frightened at its failure in 1846; but potatoes have decreased 336,000 acres since 1861. I mention these figures to show on what a different footing meadow and clover stands. Its extent in 1847 was 1,138,946 acres; in 1887 it was 2,143,538 acres. Since 1851, which is perhaps a better year to take, meadow and clover have increased 897,000 acres. In the same interval tillage has decreased 1,691,000 acres. Now if we suppose all the land which was withdrawn from tillage since 1851 became meadow and clover, there is still a balance of 794,000 acres to be accounted for, and this has probably been turned into grass, and contributed to swell the 1,303,000 acres by which grass has increased since 1851. Grass, and meadow, and clover together have increased since 1851 by the enormous quantity of 2,200,000 acres. Tillage has decreased 1,691,900 acres. Dr. Hancock, writing in 1863, says, in his valuable report on *The Supposed Progressive Decline of Irish Prosperity*, that:—

"The true test of national decline is a decrease in the amount of land under cultivation, and not on the amount of produce, so far as this is influenced by the seasons; the one is within human control, and depends on human arrangements, which in this case are governed by the reasonable hope that unfavourable seasons will not always recur; the other is as variable as the sunshine, the clouds, and the prevailing winds, on which, in this country to a greater extent than on human industry, the amount of produce in any year depends."

Without giving an unqualified acceptance to the opinions here expressed, the tremendous and continued falling off in tillage, coupled with the diminution in our population, is to me a source of great anxiety. The aggregate wealth of a country may or may not be greater at one time than another; but the progressive decline in its cultivated land and population must arrest the attention of all.

The Registrar-General, in his paper on the Waste Lands of Ireland,* and in his evidence given before Lord Cowper's Commission, questions 126-146, explains why it is that the waste land in Ireland has apparently increased of late years. The increase from 1874 to 1887 amount to 617,500 acres. The Registrar-General attributes the increase to greater care on the part of the enumerators, in picking out scraps of waste land of all kinds which were before overlooked, and

* Read before the Statistical Society, April 29th, 1884.

also to the fact that land which ceased to graze cattle and sheep would be returned as waste. If this be so, the importance of knowing every year what variation has taken place in the instructions given to the enumerators cannot be overestimated, seeing that at one time they return 617,500 acres of waste land more than at another time, when in reality no increase has occurred, if the Registrar-General's explanation is correct.

I can scarcely think such a large extent as 617,500 acres could be overlooked. If such is the case, it shows how much we are indebted to the present Registrar-General, whose well-known desire for accurate information has led to the detection of such a large error. When the figures are more closely examined, it will be found, I think, that the picking out process does not account for the whole 617,500 acres.

The extent under meadow and clover—in other words, the acreage of the Irish hay crop, is perhaps more liable to error than the acreage under tillage crops, but its large increase cannot be explained away by a variation in the instructions given to the enumerators. The hay crop is now one of the most important in Ireland, exceeding in acreage the total extent under oats and potatoes. It is not, however, equal in value; I should be sorry to exchange an acre of potatoes for an acre of hay.* Since 1883 meadow and clover have increased 212,000 acres, which increase is almost equal to the total extent under wheat and barley in 1887. This is the greatest leap it has taken without a check since the four years ending 1860. The great rise at both periods is, I believe, due to different causes. The recent increase cannot all be accounted for by a variation in the number of cattle, sheep, and horses. The diminution in the quantity of oats grown for feeding purposes may have caused some of the increase; but there can be little doubt, the bulk of the increase in meadow and clover since 1883 is due to the fact that tillage does not pay, and is more troublesome. To what extent farmers are meadowing their ancient pasture year after year, and thus spending their capital by diminishing the producing power of the land, it is difficult to say; but it is impossible to have 2,143,000 acres of meadow and clover under rotation, when there are only 2,921,000 acres under other crops, as at present. The Registrar-General informs me that in future meadow and clover will be sub-divided into, meadow under rotation, and old meadow.

If bog and waste had decreased in 1887, and meadow and clover had increased, it might be said that owing to the drought, that farmers on the margins of lakes, rivers, and swamps were enabled to meadow land which floods prevented them mowing in ordinary years—that therefore the land was not returned as bog and marsh; but in one of the driest summers on record, bog and marsh has increased 82,000 acres; this is really "bog and marsh," as distinguished from "barren mountain land, water, roads, fences, etc." So that the drought of 1887 had no influence whatever in checking the increase in bog and marsh. This is remarkable.

* It costs from £25 to £30 to grow an Irish acre of potatoes near Dublin.

Meadow and clover has increased in 1887 49,000 acres, but tillage has decreased only 18,700 acres; therefore, we must come to the conclusion that last year, even if the farmers laid down all the land with grass seeds which they ceased to till, they would have to mow 30,500 more of their old pasture, to make up the increase in meadow and clover. During the drought, farmers were driven to their wits' end to feed cattle and sheep,* and many were forced to turn them in on land intended for meadowing. This would tend to contract the extent of the hay crop; but it has increased. The diminution in the number of cattle in 1887 will not account for the increase in meadowing, because the drought was far more severe on the pastures in the S. and S. E. of Ireland, than if the number of cattle and sheep had been doubled during its continuance. The hypothesis which accounts best for the increase is that the cattle had to be partially starved in the summer, in order to mow a larger extent of pasture to feed them in the winter. To provide cattle with water, it had in many cases to be drawn for miles. The drought was particularly severe on stock owners. Those who had fat lambs to sell deeply regretted keeping them during the drought. Fortunately, the hay crop of 1886 was abundant, and many fed their cattle with old hay in June and July. Mr. Graves of Rosbercon Castle, New Ross, writes that an extensive trade was done there in selling water, up to November. As a rule, there was no aftergrass in 1887 in the dry region, and the hay crop was very light. Hay is now selling in Dublin at £5 to £5 10s. per ton, which last year could be purchased for £3 and £3 10s.; but even at the higher figure, those who live by growing hay for sale are not compensated, because the importation of foreign compressed hay checks the rise, and prevents it reaching that price which would recompense the producer for the deficiency in yield, owing to the drought.† The threat of an importation is often as effectual in reducing prices as an importation itself. If rents were regulated by the price of hay, the tenants of the S. E. of Ireland, who suffered most by the drought, would have to pay the highest rent; whereas those in the N.W., who suffered least, would pay the lowest rents. Hay is now being imported from Belfast to Dublin. The hay crop was never saved with less trouble or in better condition; so that although the produce is small the quality is excellent. When the rain came the pastures kept green longer than usual, and there was a good bite of grass in the late autumn.

The Dublin dairymen pay higher rents than graziers or tillage farmers. A good sod of the best grasses near Dublin will fetch £4 or £5, and even £6 per acre for the summer season, if handy and suitable for dairy cows. What were these fields worth this summer? The cows would starve instead of milking. As a consequence, many had to house-feed their cows as in winter time, or give them artificial

* In some places they mowed the oats green to feed the cattle.

† By looking over the bills of entry for the port of Dublin, I have ascertained that in the last five months of 1887, 2,452 packages of compressed hay were imported from Rotterdam, and 698 from Nantes. In the corresponding period for 1886 no hay was imported into Dublin.

feeding on the field. In the summer of 1886 brewers' grains in Dublin could scarcely be got rid of at 3d. per barrel—they are largely used for feeding dairy cattle; in 1887 they were 1s. per barrel, or four times the 1886 price. The dairymen had to pay an increased price for grains, and pay also a high rent for pasture which was almost worthless, until August 20th.* It is safe to assert therefore that the profits of the Dublin dairymen in 1887 were small. From June 1st to August 1st, 1886, there was little or no rise in the price of butter in Cork. In 1887 it rose 30s. per cwt. in the same time, owing to the drought. The price June 1st both years was about the same. The dry summer had some beneficial effects—less smut is reported in the corn, there is said to have been less ergotized grass, and there was no potatoe disease. Fungi, whether microscopic or otherwise, require moisture for their development, and the three effects just mentioned, being of fungoid origin, are probably due to the deficient rainfall.

Potatoes.

There are some very remarkable features about the potato crop of 1887; and as a large acreage has been cultivated at Fassaroe for 53 years, without interruption, they naturally interest the grower. If the map be referred to it will be seen that it is pretty evenly distributed. In Mayo, Leitrim, Cavan, Armagh, and Down the black dots are somewhat the thickest, and fewest in Kildare, Wicklow, and Westmeath. The dots show not only the number of acres, but the number of acres in proportion to the size of the county. It is not easy to grasp this at once from the agricultural statistics. The general potato crop is sown in March and April—the great bulk of it in April. April, 1887, was the coldest for 22 years save one; but like the rest of the spring it was extremely favourable for farm work, and the potato crop was planted in good order. The extent under potatoes in 1887—796,000 acres—shows a falling off of 335,000 acres since 1861. May was dry, June was very dry and hot, July was dry and warm, and the drought on the east coast continued until August 12th. The potato being a native of a climate with a much higher mean summer temperature than Ireland, grew notwithstanding the drought, but owing to the exceptional character of the season, a report was circulated in the daily prints in August that the crop in Ireland was a failure, because no tubers could be found under the stalks; but the champion variety is well known not to grow much until September, therefore all these alarming rumours were premature.

Between August 12th and September 11th much rain fell, and this saved the potato crop in the E. and S. of Ireland. In the W. and N. there never was much danger; on the contrary, the crop in the W. and N. is one of the best since the famine, and this, coupled with a fine turf season, has greatly helped the farmers in the west.

* The drought around Dublin came to an end on August 12th, on which day 1.100 inches of rain fell, but it was not until the 20th that the pastures showed a greenish tint.

The drought continued sufficiently long to check the growth of the fungus *Peronospera infestans*, and the rain came when the tubers were swelling. For the first time in my recollection there is practically no disease, nor is there any mention of it except in a few very limited areas. Nothing proves so clearly its fungoid origin as its prevalence in wet seasons and comparative absence in dry ones. We cannot have everything, and the rain came a little late for dry ground; and in such cases the stalks of the champion, not having grown as they should in July, had a large amount of stored up energy; and like the pastures, they remained green up to November; in fact champion potatoes in dry soil were hardly fit for storing until December. The crop is above the average in the W. and N., and on damp boggy land everywhere above it; on light soil it is below the average in the E. and S., but the freedom from disease seems almost universal. In dry soil there was much second growth when the rain came; this deteriorates the quality of the tuber, rendering it wet and soapy, an effect of the dry season not known by consumers generally.

There is no article of farm produce which fluctuates in price like the potato; its yield is uncertain; it cannot be held over from one season to another, like wheat or oats; and foreign competition does not so quickly replace a deficiency at home. Therefore its price is liable to sudden and great variation. Rents fluctuating with the price of potatoes would sometimes be doubled in a month. Every year there is a rise about the end of June, when the old potatoes are just out and the new ones are coming in. In June, 1887, the price was about 3s. 6d. per cwt. In the first week in July the price was 8s. to 11s.* per cwt. This represents a rise, which takes place to a greater or less extent every year, early in July; but in 1887 the early potatoes were a partial failure, owing to the drought, and the rise in prices showed itself even in October—the price being 2s. 10d. to 4s. in 1887, against 2s. to 3s. the corresponding week in 1886. The price of potatoes now in Dublin is 2s. to 2s. 4d. per cwt. wholesale. What would millers think of wheat starting at 20s. per barrel in April, rising to 50s. in July, and falling to 14s. in December? Yet potato-growers are quite accustomed to fluctuations on a similar scale. The abundant yield of the potato in the W. and N. in 1887 was not felt in Dublin until November or December—when the railways poured potatoes into the city, and lowered the price on the Dublin farmers.† Potatoes are now delivered on rail at £2 per ton in Dublin from stations in the west. As a matter of fact, a good year of potatoes is a bad year of profit with those who grow *for sale*. It is, perhaps, to be accounted for this way.—When the season is wet the potatoes in the W. are a failure owing to disease; in the E. they are a partial failure; but not so bad as in the W. with its moist

* No early potatoes are sold at Fassaroe, and these figures are taken from the Registrar-General's Report, compiled from the Dublin journals.

† The Secretary of the Midland Great Western Railway has kindly furnished me with the quantity of potatoes imported into Dublin by that line in the last quarter of 1886 and 1887, respectively. The figures are—1886, 33 tons; 1887, 1,024 tons. No doubt the amount carried by other lines and by the canal has also greatly increased owing to the good crop.

climate. The price rises rapidly, and the east coast farmer reaps the benefit. Many of the large Scotch potato-growers prefer a year when the crop is diseased, as the following quotation will show :—

“It is one of the many peculiarities of potatoes, as an article of commerce, that the producer is not always best remunerated when the crop is largest. Indeed it would be nearer the truth to say the reverse is the case.”*

Tested by the Fassaroe accounts for the past fifty years, the statement is generally true. In Ireland a deficiency or excess in the potato crop influences the growers so differently in various parts of the country, that to apply any general rule to all, would more surely work injustice than in the case of perhaps any other crop. I have heard that an attempt to regulate rent by the price of potatoes failed some time since in the Lothians of Scotland.† The last observation which I shall make about the potato crop is also true of the turnip crop this year. The manure round the potatoes in dry fields did not rot as well as usual, and more of it remains to benefit the corn crop next year.

Turnips and Mangolds.

There is about 1 acre of mangolds grown in Ireland for every 8 acres of turnips. Eight counties have each less than 500 acres of mangolds. Antrim, Armagh, Cavan, Leitrim, Londonderry, Longford, and Mayo, have the smallest acreage. Clare has more mangolds in proportion to turnips than any county in Ireland. A warm summer is known to be suitable for the mangold crop—it likes deep, well-manured land, and drought has much less influence on it than turnips. This year, however, the rain was too long delayed, and except on boggy land, the crop is not above the average. Mangold is one of the few crops in Ireland which has increased since 1851, but its acreage is small. In 1851 it was 25,800 acres, in 1887 it was 41,600 acres. Turnips on the other hand have decreased from 383,000 acres in 1851, to 300,000 acres in 1887. If we take the last decade, however, mangolds, as well as turnips, have decreased—the former by about 7,300 acres, and the latter by 34,000 acres.

Turnips are most important to Ireland; along with hay they form the principal food for cattle in winter time. Of all the crops they are most influenced by want of moisture, and, as a consequence, the turnip crop of 1887 is far below the average, where there has been a great deficiency in the rainfall. On many farms it is a complete failure. This, coupled with a small hay crop, will put a severe strain on all who have to feed cattle this winter, unless it proves a very mild and open one. Nothing was so surprising as the way *some* turnip fields survived the blazing heat in June and July. I attribute this to the favourable spring, which enabled them to be sown with the ground in good order. Although turnips in well cultivated ground

* “The Potato Supplies of Great Britain.” See *North British Agriculturist*, November, 1887.

† I am at present making inquiries as to the truth of this statement and the cause of the alleged failure.

survived the drought, they got what farmers call "a set," from which they never recovered, and when the rain came in August the roots were unable to swell, and the greater part of the vegetable energy was devoted to the development of leaves. This gave the fields a green appearance, which was very deceptive. There were plenty of leaves, but small roots. It will be found that the turnip crop of 1887 is below the average for all Ireland, and the worst since 1879 in the region where the rainfall was most deficient. No crop suffers more from the attacks of insects. When the young plants shoot above the ground, the first two leaves are the favourite food of the turnip fly or flea beetle (*Haltica nemorum*), and should they survive the injuries of this pest, the leaves in a dry summer are attacked by the aphid, or green plant louse of the turnip crop (*Aphis rapæ**). It is unnecessary in such a paper as this to do more than to refer to the extraordinary life history of the aphides or plant lice—which enables them to propagate with enormous rapidity, and makes them to the entomologist one of the most interesting groups in the animal kingdom. For the present purpose, it is sufficient to state, that the aphides flourish in a drought, and that they played a most important part this year in the destruction of the turnip crop. Some thought they were Hessian flies; even educated people seemed to consider them some new plague. They are with us every year, but in dry and warm summers they multiply in a most marvellous manner. At Fassaroe there were about 30 statute acres of turnips, and had August been dry, the aphides would have left the crop worthless. It is said that in 1842 they totally destroyed 600 acres of turnips in Northumberland;† and had August been dry in Ireland in 1887, they would have completed the destruction of the turnip crop in some districts. The plant lice pierce the leaves with their suckers, and pump the sap into their bodies—the leaves become curled and distorted, and then drop to the ground, and the whole plant becomes one crawling mass of those green vermin.‡ The Swedish turnip, which forms almost the entire crop in Ireland, is most liable to attack. The price of Swedish turnips in Dublin, at one time in November, was equal to the price of potatoes—an occurrence which illustrates in a striking manner the effect of the drought on both crops. Turnips have since fallen in price by one-half.

Cabbages, which are closely allied to turnips, are grown to about the same extent as mangolds, the area planted being 43,700 acres; but like the turnips they are far more influenced by drought, and in some districts were nearly all destroyed by the caterpillars of the cabbage butterfly (*Pieris brassicæ*), which flourishes of a dry season. The cabbage crop is therefore below the average.

Sir John B. Lawes, Bart., the well-known authority on agriculture, whose experiments at Rothamsted have a world-wide reputation, writing to me on 23rd ult., says:—

* *Curtis' Farm Insects* p. 68; *A Manual of Injurious Insects*, by E. A. Ormerod, p. 143; *Monograph of British Aphides*, by C. B. Buckton, F.R.S.

† *Zoologist*, vol. i. p. 123.

‡ As to the enemies of the aphides, see *Curtis' Farm Insects*, p. 71.

“I do not think that those who legislate for the country [Ireland] are sufficiently alive to the importance of climate in relation to food. About 96 per cent. of our crops are derived from an atmospheric source over which we have little or no control. I have heard and seen in the writings of sensible men a reference to the splendid fruit and vegetables grown upon peat bogs near Paris, and the question asked why does not Ireland make use of her bogs in the same manner, quite ignoring the difference in temperature. Ireland is essentially a country for sheep and cattle, and a dense population must sooner or later fall back on the potato, if the population is to live upon the produce of the soil.”

As to how far the sheep and cattle theory is consistent with prosperity or with Dr. Hancock's statement*—that “the true test of national decline is a decrease in the amount of land under cultivation”—time does not permit me to discuss. Sir J. B. Lawes' letter is quoted to show the influence of the weather on agricultural produce, and the importance of considering the meteorological position of Ireland, not alone compared with other countries, but the climate of one part of Ireland compared with another. Looking at the maps which illustrate this paper, and taking the two extremes, the great difference in the produce of the N. W. and S. E. of Ireland in 1887 will be apparent.

In a country which is so dependent on agriculture, and in which the weather is so variable, it is absolutely necessary every year to consider both the soil and climate of each district at the great growing period of the year. To reason from the state of one county to that of all would lead to the most erroneous conclusions, especially in such a remarkable season as that of 1887. Therefore the produce returns which the Registrar-General will shortly issue for the past year, and from which those who govern this country draw their conclusions as to the yield of the crops, must be analyzed, and no hasty conclusion arrived at from the general result. If we go further, and wish to compare the produce of 1887 with other years, care must be taken to see that the same class of enumerators were employed and made out their returns at the same period of the year, and were acting on the same instructions. Further, it must be borne in mind that as Ireland is going out of tillage decade after decade, the last land to be cultivated is that which pays best, and which yields the largest produce, and therefore it is no answer to the statement that “the soil of Ireland is deteriorating,” to say that the agricultural statistics show no decline in produce, even if the returns had always been collected in the same manner. I do not say it is deteriorating.

Having now, to the best of my ability, shown you some of the effects of the drought of 1887 on Irish agriculture, in a paper which some may consider more remarkable for its length than its real value, I will conclude by conveying my best thanks to all those observers who were good enough to furnish me with the rainfall statistics and information as to the crops. Without their aid this paper could not have been written. To the Registrar-General for Ireland I am under many obligations. He is ever ready to oblige and to supply those who agree and those who differ from him with all the information in his power.

* Report on *The Supposed Progressive Decline of Irish Prosperity*, presented to the Lord Lieutenant in 1863, p. 41.

Note added in the press.

The following table is taken from the Agricultural Statistics, showing the produce of the crops in 1887. These were issued subsequent to the reading of the foregoing paper; but corroborate in a remarkable manner the statements made as to the effects of the drought.

TABLE VI.—SHOWING THE AVERAGE RATES OF PRODUCE PER ACRE OF THE PRINCIPAL CROPS FOR THE 10 YEARS, 1877-1886; THE AVERAGE RATES FOR 1886 AND 1887 RESPECTIVELY; THE INCREASE OR DECREASE IN THE RATE FOR EACH CROP IN 1887 COMPARED WITH 1886, AND WITH THE AVERAGE RATE FOR THE 10 YEARS, 1877-1886.

Crops.	Average Rate of Produce per acre for the 10 years 1877-'86.	Average Rate of Produce per acre in 1886.	Average Rate of Produce per acre in 1887.	Increase or Decrease in 1887 compared with 1886.		Rate of Produce in 1887 compared with average Rate for the 10 years 1877-1886.	
				Increase.	Decrease.	Above.	Below.
Wheat, in cwts. ...	14'1	14'5	15'2	0'7	—	1'1	—
Oats, " ...	13'3	13'9	11'5	—	2'4	—	1'8
Barley, " ...	15'2	15'3	12'8	—	2'5	—	2'4
Potatoes, in tons, ...	3'2	3'3	4'5	1'2	—	1'3	—
Turnips, " ...	12'1	13'3	9'1	—	4'2	—	3'0
Mangel Wurzel and Beet Root, in tons, ...	12'8	13'5	10'9	—	2'6	—	1'9
Flax, in stones of 14 lbs. ...	28'7	29'2	18'6	—	10'6	—	10'1
Hay, in tons, ...	2'1	2'1	1'7	—	0'4	—	0'4

It will be observed that every crop is deficient in produce except wheat and potatoes. On comparing the produce of 1887 with other years I find the following facts:—Oats is the worst crop since 1872, and the worst crop but three for forty years. Barley is the worst crop since 1879, and is also the worst but three for forty years. Turnips are the worst crop since 1879, and the worst but two for forty years. Mangolds are the worst crop since 1879, and are the worst but five for forty years. Hay is the worst crop since 1868, and the worst but two for forty years. Flax is the worst crop since 1871, and the worst but one for forty years.

The produce returns were first collected just forty years ago, *i.e.*, in 1847.