

Paper on the " Influence of Season on the Produce of Wheat

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THE INFLUENCE OF SEASON ON THE PRODUCE OF
WHEAT.

By J. B. LAWES.

It is proverbial that the weather exerts a very powerful influence on the produce of our fields. The accounts of the condition of the crops about the time of harvest, which are collected with much care by some of the agricultural papers, give, under the terms average, above average, below average, good, bad, &c., the opinions of individuals as to the probable yield of the most important crops in many different localities. In other words, they sum up, in general terms, the probable effects of the weather of the particular season on the quantity and quality of its produce. But they at the same time necessarily take into account a great many influences besides those of the weather alone. Indeed, even were it possible to reduce these general terms to figures, and it were attempted to state numerically the proportion which the produce of one season bears to that of another, or to the average of any number of seasons, the figures would not show the comparative effects of the seasons alone, unless the crops reported on were grown under otherwise the same conditions year after year in the same locality. It would be necessary to this end that the character of the land should be the same; and that the tillage operations, the previous course of cropping, and the manuring, should also have been very nearly the same each year. But we know that these conditions do not remain the same.

In a field at Rothamsted in which Wheat has been grown on some plots without manure, and on others with different descriptions of manure for twenty successive years, the tillage operations having been, as far as the seasons would allow, the same year after year, the essential conditions for comparing the productive characters of one season with that of another are perhaps better fulfilled than in the case of most records of ordinary farm practice. Unfortunately, none of the plots have been dressed with exactly the same description and quantity of manure every year since the commencement, excepting the one with farmyard dung; and owing to the great accumulation of almost every important constituent that must take place within the soil when a large quantity of this manure is annually employed, it is obvious that the difference in the amount of produce yielded by it year after year, cannot be taken as simply due to the comparative effects of the different seasons. Many of the plots have, however, been supplied with artificial mineral manures alone, or with mineral

manures and ammonia salts together, without any material change either in the description or the amount employed, for the last twelve or fifteen years; and as there is sufficient evidence that the influence of these manures upon the crop of the succeeding year is comparatively limited, I propose to compare the produce and increase obtained by the application of some of these artificial mixtures in the remarkable season of 1863, with the average result yielded by the same manures over the last twelve years.

Many years ago, in a paper published in the journal of the Royal Agricultural Society of England, it was stated, as the result of the experiments now under consideration so far as they had then proceeded, that the farmer might assume, for practical purposes, that he would on the average of seasons, get one bushel of increased produce of wheat, with its proportion of straw, for every 5 lbs. of ammonia applied as manure for the crop, provided the soil were not deficient in the necessary mineral constituents. This statement met with much ridicule from Baron Liebig, who said it was "a mere stroke of fancy." Whether the statement in question, or this condemnation of it, partakes most of "a mere stroke of fancy," may be judged by the following record of facts relating to it.

On one of the experimental plots a complex mineral manure has been applied every year for the last twelve years, and on another the same mineral manure, with an amount of ammonia, salts containing 50 lbs. of ammonia, has been annually applied. The average annual produce of wheat over the last twelve years has been—

With mineral manure and 50 lbs. of ammonia	Bushels. 28 $\frac{1}{2}$
With mineral manure alone	18 $\frac{1}{2}$
Increase by the use of 50 lbs. of ammonia	10

Taking the average of twelve years, therefore, we have in this experiment an increase of exactly 1 bushel of wheat, with its proportion of straw, for every 5 lbs. of ammonia. I propose, then, to consider this as the yield in a season of average productiveness; and, adopting this standard, to consider a season good or bad in proportion as it gave more or less increase than 1 bushel of wheat and its proportion of straw for every 5 lbs. of ammonia used as manure.

In 1863 the same mixture of mineral manure and ammonia-salts gave a produce of 39 $\frac{1}{2}$ bushels, or an increase of 21 bushels over the average produce with the mineral manure alone. In this experiment, therefore, 5lbs. of ammonia has given, in the sea-

son of 1863, an increase of more than 2 bushels of Wheat and its equivalent of straw, or more than 100 per cent. above the average effect.

On another plot, with the same mineral manure, but with the large amount of 100lbs. of ammonia annually applied, the average result over twelve years was as follows:—

	Bushels.
With mineral manure and 100lbs. of ammonia, ...	36½
With mineral manure alone, ...	18½
Increase by the use of 100lbs. of ammonia, ...	18

There is, then, even with this comparatively heavy dressing an average of nine-tenths of a bushel of increase of Wheat, and its proportion of straw, for every 5lbs. of ammonia employed in the manure. In 1863 this plot gave 53½ bushels, or an increase of 35 bushels over the average produce with the mineral manure alone; that is, again very nearly 100 per cent. over the average result.

On another plot where, in addition to the mineral manure, a still larger amount of ammonia was annually employed, the produce amounted in 1863 to nearly 1 ton 13 cwt. of grain, and more than 3 tons of straw per acre. Large as this produce is, it would doubtless have been larger, had not the heavy storms of June laid the crop completely flat, in which condition it remained up to the time of harvest.

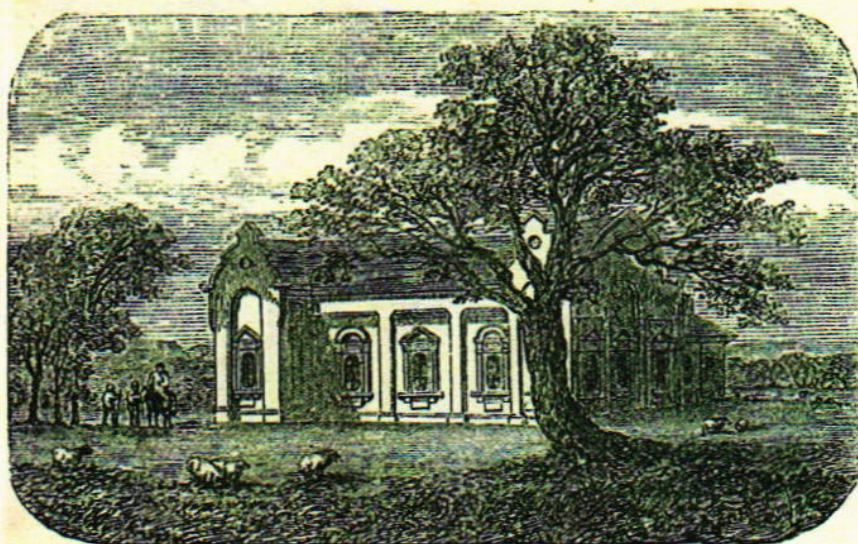
Throughout the twenty years of the experiments no season has yielded a crop at all equal to that of 1863. In 1847, 1857, and especially in 1854, the produce was very large, and in both 1854 and 1857 that obtained by the mineral manure alone even exceeded that by the same manure in 1863. But owing to some peculiar meteorological influences in 1863 (which deserve a careful study), the increase of crop was, in every instance where ammonia, salt or nitrate of soda was employed, very much greater in that year than under like conditions in any preceding season. It was about 100 per cent. over the average of the last twelve years, and in many cases about 400 per cent. over that of the worst of those twelve seasons. In fact, the results of the whole set of experiments are perfectly consistent with those of the individual cases that have been quoted, in showing the extraordinary productiveness of 1863, compared with that of any of the other years under consideration, whenever ammonia, or nitrogen in some other available form, was liberally supplied in the manure.

There is no doubt that the wheat crop of 1863 has been pretty generally a large one. But it would be fallacious to conclude from the results above referred to, that it has been over any very extensive area so much above the average as in the case of the experiments quoted. The season might possibly be too dry for wheat growing on many of the lighter descriptions of soil. And as the experimental plots manured with the mineral manure without ammonia, gave a less crop in 1863 than in either 1854 or 1857, it may perhaps be judged that the past season would not be unusually favourable for the crop on lands deficiently supplied with nitrogenous manure.

At any rate the effect of ammonia on the crop was, at Rothamsted, much greater in 1863 than in any preceding year of the experiments. And the fact that by its use, the crop was increased from $18\frac{1}{2}$ bushels (the average produce by the mineral manure alone) to $56\frac{1}{2}$ bushels, in the twentieth year of the growth of wheat on the same land, is surely a very significant one, and well worthy the careful consideration of those who maintain that the atmosphere is a sufficient source of ammonia (or nitrogen in some other available form) for cultivated crops, and that it is of little value or importance as a constituent of manures.

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