

WHEAT GROWN YEAR AFTER YEAR
ON THE SAME LAND,

AT

ROTHAMSTED, ENGLAND;

WITHOUT MANURE, WITH FARMYARD MANURE,

AND

WITH VARIOUS ARTIFICIAL MANURES.

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WHEAT GROWN AT ROTHAMSTED.

THE following description is arranged to accompany photographs of specimens of wheat grown on selected plots in Broadbalk Field, in each of the two seasons 1878 and 1899. In 1878, the crops being unusually bulky, and standing up well, it was decided to collect specimens for preservation; and in 1899, when they were again both bulky and characteristic, a corresponding collection was made, partly with the view of sending a case of the specimens to the Paris Exhibition. The photographs show the produce of the selected plots in 1878, the thirty-fifth, and in 1899, the fifty-sixth, year of wheat in succession. The description of wheat was, in 1878, the Red Rostock, and in 1899, the Club, or Square Head: but the general similarity of the two crops, grown on the same plots with the same manures, with an interval of twenty-one years between them, is very striking. Yet, detailed examination of the characters of the two seasons, and of the two crops, shows that there were some characteristic differences between them. The chief points of difference brought out by the photographs are, that there is as a rule less height of straw, under corresponding conditions of manuring, in the later than in the earlier year.

The autumn of both seasons, 1877 and 1898, was dry and favourable for working the land and getting in the seed; but that of 1898 was much warmer and much drier than that of 1877. The winter of both seasons was warmer than the average, with some deficiency of rain in 1877-8, but an excess in 1898-9. The conditions were, therefore, in both cases favourable for early growth. In 1878, the latter half of the spring was unusually warm, with at the same time a considerable excess of rain, furthering continued luxuriance; and on some plots, especially that with farmyard manure,

the crops were attacked by the "Wheat-midge," which caused considerable damage. In 1899, the temperature of the spring months was very variable, with about average rainfall, upon the whole favouring continued luxuriance with little maturing tendency. So far, then, both seasons were conducive to continued luxuriance and bulk of crop. June, July, and August were, in 1878, characterised by variable temperatures, about an average total amount of rain, but some heavy falls and thunderstorms. The crop stood up well, however, and ripened fairly. In 1899, the temperature of the summer was less variable, upon the whole considerably in excess of the average, with at the same time great deficiency of rain, tending to too rapid ripening.

The following Table shows the produce on the respective plots in each of the two seasons; and for comparison the average over forty-six years, 1852-1897, is also given:—

Plots	Manures	Manures and Produce per acre								
		Dressed Grain			Total Straw			Weight per bushel of Dressed Grain		
		1878	1899	Average 46 years 1852-'97	1878	1899	Average 46 years 1852-'97	1878	1899	Average 46 years 1852-'97
		bush.	bush.	bush.	cwt.	cwt.	cwt.	lb.	lb.	lb.
2	Farmyard Manure	28½	42½	35½	36½	52½	33	60·9	61·8	60·5
3	Unmanured	12½	12	12½	9½	9½	10½	59·0	61·7	58·6
5	Mixed Mineral Manure	14½	12½	16	11½	12	12½	68·8	62·2	59·2
6	As 5, and Amm.-salts=43 lb. N...	22½	18½	24½	26½	19½	21½	60·8	61·9	60·0
7	As 5, and Amm.-salts=86 lb. N...	31½	31½	35½	44½	40½	32½	60·6	61·6	60·0
8	As 5, and Amm.-salts=129 lb. N...	38½	39½	36½	56½	59½	40½	60·3	61·1	59·9
9 (or 16)	As 5, and Nitrate of Soda=86 lb. N...	37½	37½	36½	50½	44½	40½	59·2	61·3	59·4

It has already been pointed out that, with the combined high temperature and excessive rainfall of the latter half of the spring of 1878, some of the crops, and especially the produce of the farmyard manure plot, suffered considerably; and it is seen that the produce of grain by the farmyard manure was much less than the average of the plot, and in a greater degree less than that of 1899. The produce of straw in 1878 was also much less than in 1899, though it was more than the average of the forty-six years.

Referring to the produce of plot 3, without manure, and of plot 5, with mixed mineral manure alone, that is without

nitrogen in either case, it is seen how remarkably close the amount of produce was in each of the two years, and how little it differed from the average of forty-six years on those plots. This is so in the case of both the grain and the straw. At the same time, the differences, such as they are, are in the direction that would be expected under the conditions of continued exhaustion of the available nitrogen of the soil; that is, the produce of 1878 is, in each case, lower than the average of the forty-six years, and that of 1899 is generally lower than that of 1878.

When we come to the plots receiving nitrogenous as well as mineral manure, it is seen that with the smallest amount of nitrogen supplied (plot 6), there is less grain than the average, especially in the later year. There is, however, more straw than the average in the earlier, but less in the later year. With twice the amount of nitrogen applied, on plot 7 as ammonium-salts, and on plot 9 (or 16) as nitrate of soda, there is, in each of the two seasons of great luxuriance, or vegetative activity, much more than the average amount of straw; more grain also than the average on plot 9 (or 16) with nitrate, but not so much as the average on plot 7 with the ammonium-salts. Then, on plot 8, with the excessive quantity of nitrogen applied, as ammonium-salts, there is considerably more of both grain and straw, especially the latter, than on the average of seasons; also more of both in the better maturing season of 1899, than in 1878.

Lastly, with the much hotter and drier summer in 1899 than in 1878, there is uniformly a higher weight per bushel in 1899. There is also, in 1878, generally a higher, and in 1899, uniformly a considerably higher, weight per bushel than the average.

Although the seasons of 1878 and 1899, to which the foregoing notes specially relate, were characterised by yielding bulky crops in the experimental wheat field, they did not even give the heaviest weights of straw obtained in the series of years commencing with 1852; whilst the yield and quality of grain were far exceeded in other years. By way of illustration, reference may be made to the produce of plot 2 with farmyard manure, and of plot 7 with mineral manure and

ammonium-salts. Thus, the produce of straw by farmyard manure exceeded that of 1878 in sixteen seasons, and that of 1899 in two seasons. On plot 7, again, the produce of straw exceeded that of 1878 in seven seasons, and that of 1899 in ten seasons. On the other hand, the yield of grain on the farmyard manure plot exceeded that of 1878 in forty seasons, and that of 1899 in six seasons—its maximum yield being $48\frac{1}{2}$ bushels in 1891; whilst the yield on plot 7 was in twenty-seven years higher than in either 1878 or 1899; and its maximum yield was $53\frac{1}{2}$ bushels in 1863, against only $31\frac{1}{4}$ bushels in 1878 and in 1899. Then as to the weight per bushel of the grain, it was very frequently higher than in the two seasons of characteristically bulky crops.