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Experiments on Wheat; Broadbalk Field

Rothamsted Research

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BROADBALK FIELD.

EXPERIMENTS ON THE GROWTH OF WHEAT YEAR AFTER YEAR ON THE SAME LAND; WITHOUT MANURE, AND WITH DIFFERENT KINDS OF MANURE.

Previous Cropping—1839, Turnips, with Farmyard Manure; 1840, Barley; 1841, Peas; 1842, Wheat; 1843, Oats; the last four Crops Unmanured. First Experimental Wheat Crop in 1844. Wheat every year since; and, with some exceptions, nearly the same description of Manure on the same Plots each year—especially during the last 28 years (1852 and since). From the commencement of the experiments in 1843-4 up to 1876-7 inclusive, the mineral manures, the ammonia-salts, and rape-cake, &c., if any, were sown in the autumn, before the seed; excepting in 1845, when, owing to the wet autumn and winter, all the manures were spring-sown; and for the crops of 1873, 4, 5, 6, and 7, the ammonia-salts applied to Plot 15 were top-dressed in the spring. Nitrate of soda has, however, always been sown in the spring. But, in consequence of the ascertained great loss of the nitrogen of the manures by drainage, especially in wet winters, it has been decided to apply only the mineral manures (and Farmyard-manure) in the autumn, and the ammonia-salts, as well as the nitrate, in the spring; excepting on Plot 15, where, for comparison, the ammonia-salts are sown in the autumn. This plan was adopted for the first time for the crop of 1878.

(Area under experiment, about 13 acres.)

Plots.	Manures, per acre, per annum.	PRODUCE PER ACRE.												Plots.	
		Average per Annum.						Total Straw.							
		Dressed Corn.			Weight per Bushel.			Dressed Corn.			Weight per Bushel.				
		Quantity.	13 Years, 1852-64.	18 Years, 1852-70.	Bushels.	18 Years, 1852-70.	26 Years, 1852-77.	13 Years, 1852-64.	18 Years, 1852-70.	26 Years, 1852-77.	Quantity.	13 Years, 1852-64.	18 Years, 1852-70.		26 Years, 1852-77.
0	Superphosphate of Lime (three times as much as on No. 5 and succeeding Plots)	18 1/2	16 1/2	15 1/2	16 1/2	15 1/2	16 1/2	15 1/2	16 1/2	15 1/2	16 1/2	15 1/2	16 1/2	15 1/2	0
1	Sulphates of Potash, Soda, and Magnesia (twice as much as on No. 5 and succeeding Plots)	16 1/2	13 1/2	13 1/2	13 1/2	13 1/2	13 1/2	13 1/2	13 1/2	13 1/2	13 1/2	13 1/2	13 1/2	1	
2	Farmyard Manure (14 tons every year)	35 1/2	34 1/2	34 1/2	34 1/2	34 1/2	34 1/2	34 1/2	34 1/2	34 1/2	34 1/2	34 1/2	34 1/2	2	
3	Unmanured continuously	15 1/2	11 1/2	11 1/2	11 1/2	11 1/2	11 1/2	11 1/2	11 1/2	11 1/2	11 1/2	11 1/2	11 1/2	3	
4	Unmanured for Crop of 1852, and since; previously Superphosphate (made with Muriatic Acid), and Sulphate Ammonia	17	14 1/2	14 1/2	14 1/2	14 1/2	14 1/2	14 1/2	14 1/2	14 1/2	14 1/2	14 1/2	14 1/2	4	
5 (a and b)	200 lbs. Ⓞ Sulphate Potash, 100 lbs. Ⓞ Sulphate Soda, 100 lbs. Sulphate Magnesia, 3 1/2 cwts. Superphosph. of Lime Ⓞ	28 1/2	20 1/2	20 1/2	20 1/2	20 1/2	20 1/2	20 1/2	20 1/2	20 1/2	20 1/2	20 1/2	20 1/2	5 (a and b)	
6 (a and b)	200 lbs. Ⓞ Sulphate Potash, 100 lbs. Ⓞ Sulphate Soda, 100 lbs. Sulphate Mag., 3 1/2 cwts. Superphos., 200 lbs. Ammonia-salts Ⓞ	37 1/2	29 1/2	29 1/2	29 1/2	29 1/2	29 1/2	29 1/2	29 1/2	29 1/2	29 1/2	29 1/2	29 1/2	6 (a and b)	
7 (a and b)	200 lbs. Ⓞ Sulphate Potash, 100 lbs. Ⓞ Sulphate Soda, 100 lbs. Sulphate Mag., 3 1/2 cwts. Superphos., 600 lbs. Ammonia-salts	38 1/2	34 1/2	34 1/2	34 1/2	34 1/2	34 1/2	34 1/2	34 1/2	34 1/2	34 1/2	34 1/2	34 1/2	7 (a and b)	
8 (a and b)	200 lbs. Ⓞ Sulphate Potash, 100 lbs. Ⓞ Sulphate Soda, 100 lbs. Sulphate Mag., 3 1/2 cwts. Superphos., 550 lbs. Nitrate Soda Ⓞ	35 1/2	37 1/2	37 1/2	37 1/2	37 1/2	37 1/2	37 1/2	37 1/2	37 1/2	37 1/2	37 1/2	37 1/2	8 (a and b)	
9 (a and b)	550 lbs. Nitrate of Soda Ⓞ, (The Nitrate for both 9a and 9b always sown in the Spring.)	23 1/2	24 1/2	24 1/2	24 1/2	24 1/2	24 1/2	24 1/2	24 1/2	24 1/2	24 1/2	24 1/2	24 1/2	9 (a and b)	
10 (a and b)	400 lbs. Ammonia-salts alone, for 1845, and each year since; Mineral Manure in 1844	23 1/2	21 1/2	21 1/2	21 1/2	21 1/2	21 1/2	21 1/2	21 1/2	21 1/2	21 1/2	21 1/2	21 1/2	10 (a and b)	
11 (a and b)	400 lbs. Ammonia-salts alone, for 1845, and each year since (except 1846 and 1850); Mineral Manure 1844, '48, '50	30 1/2	23 1/2	23 1/2	23 1/2	23 1/2	23 1/2	23 1/2	23 1/2	23 1/2	23 1/2	23 1/2	23 1/2	11 (a and b)	
12 (a and b)	400 lbs. Ammonia-salts, 3 1/2 cwts. Superphosphate	35 1/2	28 1/2	28 1/2	28 1/2	28 1/2	28 1/2	28 1/2	28 1/2	28 1/2	28 1/2	28 1/2	28 1/2	12 (a and b)	
13 (a and b)	400 lbs. Ammonia-salts, 3 1/2 cwts. Superphosphate, and 200 lbs. Ⓞ Sulphate of Soda	35 1/2	29 1/2	29 1/2	29 1/2	29 1/2	29 1/2	29 1/2	29 1/2	29 1/2	29 1/2	29 1/2	29 1/2	13 (a and b)	
14 (a and b)	400 lbs. Ammonia-salts, 3 1/2 cwts. Superphosphate, and 280 lbs. Ⓞ Sulphate of Magnesia	35 1/2	32 1/2	32 1/2	32 1/2	32 1/2	32 1/2	32 1/2	32 1/2	32 1/2	32 1/2	32 1/2	32 1/2	14 (a and b)	
15 (a and b)	200 lbs. Ⓞ Sulph. Pot., 100 lbs. Ⓞ Sulph. Sod., 100 lbs. Sulph. Mag., 3 1/2 cwts. Superphos., Ⓞ; 400 lbs. Amm.-salts, in Autm. Ⓞ	35 1/2	31 1/2	31 1/2	31 1/2	31 1/2	31 1/2	31 1/2	31 1/2	31 1/2	31 1/2	31 1/2	31 1/2	15 (a and b)	
16 (a and b)	1852-64, 13 years, 200 lbs. Sulph. Potash, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag., 3 1/2 cwts. Superphos., and 800 lbs. Ammonia-salts; average produce 39 1/2 bush. Corn, 46 1/2 cwts. Straw	39 1/2	15 1/2	15 1/2	15 1/2	15 1/2	15 1/2	15 1/2	15 1/2	15 1/2	15 1/2	15 1/2	15 1/2	16 (a and b)	
17 (a and b)	1865 and since, unmanured; average produce (14 years, 1865-78) 15 1/2 bushels Corn, 13 1/2 cwts. Straw	18 1/2	14 1/2	14 1/2	14 1/2	14 1/2	14 1/2	14 1/2	14 1/2	14 1/2	14 1/2	14 1/2	14 1/2	17 (a and b)	
18 (a and b)	200 lbs. Ⓞ Sulphate Potash, 100 lbs. Ⓞ Sulphate Soda, 100 lbs. Sulphate Magnesia, and 3 1/2 cwts. Superphosphate	32 1/2	26 1/2	26 1/2	26 1/2	26 1/2	26 1/2	26 1/2	26 1/2	26 1/2	26 1/2	26 1/2	26 1/2	18 (a and b)	
19	1878-9, 1700 lbs. Rape-cake; 1852-78, 3 1/2 cwts. Superphos. Lime Ⓞ, 300 lbs. Sulph. Amm., and 500 lbs. Rape-cake, in Autm.	32	26 1/2	26 1/2	26 1/2	26 1/2	26 1/2	26 1/2	26 1/2	26 1/2	26 1/2	26 1/2	26 1/2	19	
20	Unmanured continuously	15 1/2	11 1/2	11 1/2	11 1/2	11 1/2	11 1/2	11 1/2	11 1/2	11 1/2	11 1/2	11 1/2	11 1/2	20	
21	200 lbs. Ⓞ Sulph. Potash, 100 lbs. Ⓞ Sulph. Soda, 100 lbs. Sulph. Mag., 3 1/2 cwts. Superphos., 100 lbs. Muriate Ammonia	22 1/2	17 1/2	17 1/2	17 1/2	17 1/2	17 1/2	17 1/2	17 1/2	17 1/2	17 1/2	17 1/2	17 1/2	21	
22	200 lbs. Ⓞ Sulph. Potash, 100 lbs. Ⓞ Sulph. Soda, 100 lbs. Sulph. Mag., 3 1/2 cwts. Superphos., 100 lbs. Sulphate Ammonia	22 1/2	18 1/2	18 1/2	18 1/2	18 1/2	18 1/2	18 1/2	18 1/2	18 1/2	18 1/2	18 1/2	18 1/2	22	

(1) 300 lbs. per annum for Crop of 1858, and previously.
 (2) 200 lbs. per annum for Crop of 1858, and previously.
 (3) "Superphosphate of Lime" in all cases, excepting for Plot 19, made from 200 lbs. Bone-ash, 150 lbs. Sulphuric acid, &c. (17 and water).
 (4) The "Ammonia-salts," in all cases, equal parts Sulphate and Muriate of Ammonia of Commerce.
 (5) 94, 475 lbs. Nitrate Soda in 1852, 275 lbs. in 1853 and 1854, 550 lbs. each year since. No Sulphate of Potash, Soda, or Magnesia, or Superphosphate, in 1852, 1853, or 1854. 96, 475 lbs. Nitrate in 1852, 550 lbs. each year since. 550 lbs. Nitrate is reckoned to contain the same amount of Nitrogen as 400 lbs. "Ammonia-salts."
 (6) For 1858, and previously—1 1/2 times as much.
 (7) For 1872 and previously, made with Muriate instead of Sulphuric Acid.
 (8) For 1872 and previously, 400 lbs. Sulphate Ammonia, sown in the Autumn; for 1873, 4, 5, 6, and 7, 400 lbs. Ammonia-salts, sown in the Spring; for 1878 and 1879, 400 lbs. Ammonia-salts, sown in the Autumn.
 (9) For 1872 and previously, 300 lbs. Sulphate Ammonia and 500 lbs. Rape-cake, sown in the Autumn; for 1873, 4, 5, 6, and 7, 400 lbs. Ammonia-salts, sown in the Spring; for 1878 and 1879, 400 lbs. Ammonia-salts, sown in the Autumn.
 (10) The Manures of Plots 17 and 18 are, year by year, transposed.
 (11) Made with Muriatic instead of Sulphuric Acid.
 (12) Averages of Mineral Manures, alternated with Ammonia-salts.
 (13) Averages of Ammonia-salts, alternated with Mineral Manures.
 (14) Plots 17 had the Ammonia-salts for the Crop of 1878.
 (15) Plots 18 had the Mineral Manures for the Crop of 1878.
 (16) Averages of 13 years, 12 years, and 25 years only; as, in 1868, owing to a mistake in carting, the produce could not be ascertained.
 The Plots marked "(a and b)" are divided into duplicate portions, "a" and "b," respectively, which are manured alike; excepting that, for the crops of 1864-5-6 and 7, the "a" portions of plots 5, 6, 7, 8, 9, 16, and 17 (or 18); and for a mixture of soluble Silicates in addition to the other Manures, but, hitherto, without any material effect; and for the crops of 1868, and since, cut straw (that produced in the previous season) has been applied (instead of Silicates) on the "a" portions of plots 5, 6, 7, 8, 11, 12, 13, 14, and 17 (or 18); also for the crop of 1874, and since, the straw of the previous season has been cut up and applied to the "a" portion of plot 15.