# Yields of the Field Experiments 1876

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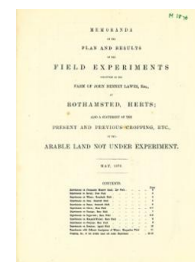
# Experiments on Wheat; Broadbalk Field

## 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 24 years (1852 and since). Unless otherwise stated, the Manures are sown in the Autumn before the seed.

(Area under experiment, about 13 acres.)

| | | | | |
|---|---|---|---|---|
| 1 acre .. .. .. | = (about) | 0·40 Hectare .. .. .. | .. or | 1·59 Prussian Morgen. |
| 1 bushel .. .. | = (about) | 0·36 Hectolitre .. .. | .. or | 0·66 Prussian Scheffel. |
| 1 lb. (pound avoir.) | = (about) | 0·45 Kilogramme .. .. | .. or | 0·91 Zollverein Pfund. |
| 1 cwt. (hundredweight) | = (about) | 51·0 Kilogrammes .. .. | .. or | 1·02 Centner. |
| 1 bushel per acre .. | = (about) | 0·9 Hectolitre per Hectare .. | or | 0·42 Pr. Scheffel per Pr. Morgen. |
| 1 lb. per acre .. | = (about) | 1·12 Kilogramme per Hectare | or | 0·57 Zollv. Pfd. per Pr. Morgen. |
| 1 cwt. per acre .. | = (about) | 125·5 Kilogrammes per Hectare | or | 0·64 Centner per Pr. Morgen. |

| PLOTS. | Manures, per acre, per annum. | PRODUCE PER ACRE. | | | | | | | | | | | | PLOTS. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Average per Annum. | | | | | | | | | Thirty-Second Season, 1875. | | | |
| | | Dressed Corn. | | | | | | Total Straw. | | | Dressed Corn. | | Total Straw. | |
| | | Quantity. | | | Weight per Bushel. | | | | | | Quantity. | Weight per Bushel. | | |
| | | 12 Years, 1852–63. | 12 Years, 1864–75. | 24 Years, 1852–75. | 12 Years, 1852–63. | 12 Years, 1864–75. | 24 Years, 1852–75. | 12 Years, 1852–63. | 12 Years, 1864–75. | 24 Years, 1852–75. | | | | |
| | | Bushels. | Bushels. | Bushels. | lbs. | lbs. | lbs. | Cwts. | Cwts. | Cwts. | Bushels. | lbs. | Cwts. | |
| 0 | Superphosphate of Lime (three times as much as on No. 5 and succeeding Plots) | 18¼ | 16¼ | 17¼ | 57½ | 59¼ | 58½ | 16½ | 13 | 14¾ | 10⅜ | 59⅜ | 10¼ | 0 |
| 1 | Sulphates of Potass, Soda, and Magnesia (twice as much as on No. 5 and succeeding Plots) | 16⅜ | 12¼ | 14⅜ | 57¼ | 59⅛ | 58¼ | 15¾ | 10⅜ | 13 | 8⅛ | 58½ | 7¾ | 1 |
| 2 | Farmyard Manure (14 tons every year) | 35⅜ | 35 | 35¼ | 59¼ | 60⅝ | 60 | 34⅝ | 32⅝ | 33⅝ | 28⅞ | 60½ | 33¼ | 2 |
| 3 | Unmanured continuously | 15½ | 12⅜ | 14 | 56½ | 59 | 57¾ | 14⅞ | 9¾ | 12⅜ | 8⅝ | 60 | 9 | 3 |
| 4 | Unmanured for Crop of 1852, and since; previously Superphos. (made with Muriatic Acid), and Sulph. Ammonia | 17 | 13 | 15 | 57¼ | 59½ | 58¼ | 15½ | 10½ | 13 | 7⅝ | 59⅝ | 8⅛ | 4 |
| 5 (*a* and *b*) | 200 lbs. (1) Sulphate Potass, 100 lbs. (2) Sulphate Soda, 100 lbs. Sulphate Magnesia, 3½ cwts. Superphosphate of Lime (3) | 18½ | 13¾ | 16⅛ | 57⅞ | 59¾ | 58⅞ | 16⅞ | 11¼ | 14⅛ | 9¼ | 59⅜ | 10 | 5 (*a* and *b*) |
| 6 (*a* and *b*) | 200 lbs. (1) Sulphate Potass, 100 lbs. (2) Sulphate Soda, 100 lbs. Sulphate Mag., 3½ cwts. Superphos., 200 lbs. Amm.-salts (4) | 28⅜ | 22⅜ | 25⅜ | 58⅝ | 60⅛ | 59½ | 26⅞ | 20¼ | 23½ | 16⅜ | 60⅜ | 17⅞ | 6 (*a* and *b*) |
| 7 (*a* and *b*) | 200 lbs. (1) Sulphate Potass, 100 lbs. (2) Sulphate Soda, 100 lbs. Sulphate Mag., 3½ cwts. Superphos., 400 lbs. Amm.-salts | 36⅜ | 32⅛ | 34¼ | 58½ | 60¼ | 59¼ | 37½ | 31⅝ | 34⅝ | 25⅞ | 59½ | 30½ | 7 (*a* and *b*) |
| 8 (*a* and *b*) | 200 lbs. (1) Sulphate Potass, 100 lbs. (2) Sulphate Soda, 100 lbs. Sulphate Mag., 3½ cwts. Superphos., 600 lbs. Amm.-salts | 38 | 37 | 37½ | 57¾ | 60¼ | 59 | 42⅛ | 40¼ | 41¼ | 29⅞ | 58⅛ | 38⅝ | 8 (*a* and *b*) |
| 9 {*a* | 200 lbs. (1) Sulphate Potass, 100 lbs. (2) Sulphate Soda, 100 lbs. Sulphate Mag., 3½ cwts. Superphos., 550 lbs. Nitrate Soda (5) | 34½ | 39⅛ | 36⅞ | 57 | 59⅞ | 58½ | 39½ | 44⅝ | 42⅛ | 30½ | 57⅞ | 42⅜ | 9 {*a* |
| *b* | 550 lbs. Nitrate of Soda (5). (The Nitrate for both 9*a* and 9*b* always sown in the Spring.) | 25⅞ | 24½ | 25¼ | 55½ | 57⅝ | 56½ | 28½ | 26⅛ | 27¼ | 16½ | 55⅝ | 21⅛ | *b* |
| 10 {*a* | 400 lbs. Ammonia-salts alone, for 1845, and each year since; Mineral Manure in 1844 | 22⅝ | 21⅛ | 21⅞ | 55⅞ | 58 | 56⅞ | 23¼ | 18½ | 20⅞ | 12¾ | 54½ | 14 | 10 {*a* |
| *b* | 400 lbs. Ammonia-salts alone, for 1845, and each year since (except 1846 and 1850); Mineral Manure 1844, '48, '50 | 27 | 23 | 25 | 57 | 58⅜ | 57⅝ | 27⅜ | 20⅛ | 23¾ | 14⅝ | 55½ | 15⅞ | *b* |
| 11 (*a* and *b*) | 400 lbs. Ammonia-salts, 3½ cwts. Superphosphate | 29⅝ | 25⅜ | 27½ | 56½ | 58⅛ | 57⅜ | 28⅞ | 22⅞ | 25⅞ | 17⅞ | 55 | 20½ | 11 (*a* and *b*) |
| 12 (*a* and *b*) | 400 lbs. Ammonia-salts, 3½ cwts. Superphosphate, and 366½ lbs. (6) Sulphate of Soda | 35⅛ | 31⅛ | 33⅛ | 58¼ | 59¾ | 59⅛ | 35¼ | 28 | 31⅝ | 25¼ | 57⅝ | 27⅛ | 12 (*a* and *b*) |
| 13 (*a* and *b*) | 400 lbs. Ammonia-salts, 3½ cwts. Superphosphate, and 200 lbs. (6) Sulphate of Potass | 34⅝ | 32⅛ | 33⅜ | 58½ | 60¾ | 59⅝ | 35⅝ | 30⅝ | 33⅛ | 27⅛ | 60¼ | 29⅛ | 13 (*a* and *b*) |
| 14 (*a* and *b*) | 400 lbs. Ammonia-salts, 3½ cwts. Superphosphate, and 280 lbs. (6) Sulphate of Magnesia | 35 | 31¼ | 33⅛ | 58⅜ | 60⅛ | 59¼ | 35¾ | 28⅜ | 32 | 26¼ | 58½ | 27⅞ | 14 (*a* and *b*) |
| 15 {*a* | 200 lbs. (1) Sulph. Pot., 100 lbs. (2) Sulph. Sod., 100 lbs. Sulph. Mag., 3½ cwts. Superphos. (7); 400 lbs. Amm.-salts, in Spring (8) | 33¼ | 31¼ | 32¼ | 58½ | 60¾ | 59⅝ | 33⅞ | 29½ | 31¾ | 23⅝ | 59⅞ | 26 | 15 {*a* |
| *b* | 200 lbs. (1) Sulph. Pot., 100 lbs. (2) Sulph. Sod., 100 lbs. Sulph. Mag., 3½ cwts. Superphos. (7); 400 lbs. Amm.-salts, in Spring (9) | 34⅞ | 32⅛ | 33½ | 58⅝ | 60⅞ | 59¾ | 35⅞ | 30¾ | 33⅜ | 27½ | 60½ | 31⅛ | *b* |
| 16 (*a* and *b*) | 1852–64, 13 years, 200 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag., 3½ cwts. Superphos., and 800 lbs. Ammonia-salts; average produce 39½ bush. Corn, 46⅝ cwts. Straw<br>1865 and since, unmanured; average produce (~~10~~ 11 years, 1865–7~~4~~ 5) 1~~7~~ 6 5/8 bushels Corn, 1~~5⅝~~ 4 cwts. Straw | 38½ | 19½ | 29 | 57½ | 60¼ | 59 | 46 | 17⅞ | 31⅞ | 10⅛ | 59⅝ | 10⅝ | 16 (*a* and *b*) |
| (10) {17 (*a* and *b*) | 400 lbs. Ammonia-salts | 32⅝ | 28⅞ | 30¾ (12) | 58⅝ | 60¼ | 59½ (12) | 33½ | 27⅜ | 30⅝ (12) | 11⅝ | 59¼ | 12 (14) | 17 (*a* and *b*) |
| 18 (*a* and *b*) | 200 lbs. (1) Sulphate Potass, 100 lbs. (2) Sulphate Soda, 100 lbs. Sulphate Magnesia, and 3½ cwts. Superphosphate | 18⅞ | 14⅞ | 16⅞ (13) | 58 | 59⅜ | 58⅞ (13) | 17⅞ | 12⅞ | 15⅜ (13) | 25⅝ | 59 | 26⅞ (15) | 18 (*a* and *b*) |
| 19 | 3½ cwts. Superphosphate of Lime (11), 300 lbs. Sulphate of Ammonia, and 500 lbs. Rape-cake | 31⅝ | 28⅝ | 30⅛ | 58⅛ | 58⅞ | 58½ | 31½ | 25⅛ | 28¼ | 22⅞ | 56½ | 22¼ | 19 |
| 20 | Unmanured continuously | 15⅝ | 12 | 13⅞ (16) | 57 | 58½ | 57¾ (16) | 15⅜ | 11⅛ | 13¼ (16) | 8⅛ | 57 | 9⅛ | 20 |
| 21 | 200 lbs. (1) Sulph. Potass, 100 lbs. (2) Sulph. Soda, 100 lbs. Sulph. Mag., 3½ cwts. Superphos., 100 lbs. Muriate Amm. | 22¼ | 19⅜ | 20¾ | 57⅞ | 59⅝ | 58¾ | 20⅞ | 16⅜ | 18⅝ | 13 | 59¾ | 12¼ | 21 |
| 22 | 200 lbs. (1) Sulph. Potass, 100 lbs. (2) Sulph. Soda, 100 lbs. Sulph. Mag., 3½ cwts. Superphos., 100 lbs. Sulphate Amm. | 21¾ | 19⅜ | 20½ | 57¾ | 59⅝ | 58¾ | 20⅝ | 16 | 18⅜ | 13¾ | 60¼ | 13¼ | 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 sp. gr. 1·7 (and water).

(4) The "Ammonia-salts," in all cases, equal parts Sulphate and Muriate of Ammonia of Commerce.

(5) 9*a* 475 lbs. Nitrate Soda in 1852, 275 lbs. in 1853 and 1854, 550 lbs. each year since; 9*b* 475 lbs. in 1852, 550 lbs. each year since; 550 lbs. is reckoned to contain the same amount of Nitrogen as 400 lbs. "Ammonia-salts."

(6) For 1858, and previously—1½ time as much.

(7) For 1872 and previously, made with Muriatic instead of Sulphuric Acid.

(8) For 1872 and previously, 400 lbs. Sulphate Ammonia, sown in the Autumn.

(9) For 1872 and previously, 300 lbs. Sulphate Ammonia and 500 lbs. Rape-cake, 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 Ammonia-salts, alternated with Mineral Manures.

(13) Averages of Mineral Manures, alternated with Ammonia-salts.

(14) Plots 17 had the Mineral Manures for the Crop of 1875.

(15) Plots 18 had the Ammonia-salts for the Crop of 1875.

(16) Averages of 12 years, 11 years, and 23 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), received 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.