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# Yields of the Field Experiments 1898



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# **Barley**; Hoos Field

### **Rothamsted Research**

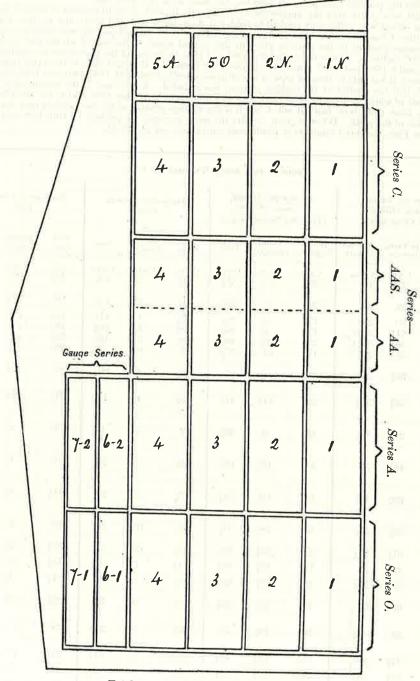
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OF THE PLOTS IN HOOS FIELD, PLAN ON WHICH BARLEY HAS BEEN GROWN

for 47 years in succession, 1852 to 1898 inclusive.

[For brief summary of results and conclusions, see opposite page.]



Total area of ploughed land about  $5\frac{1}{2}$  acres.

Area of Plots.

1, 2, 3, and 4, of Series O, Series A, and Series C, each  $\frac{1}{11}$  acre. 1, 2, 3, and 4, of Series AA, and Series AAS, each  $\frac{1}{11}$  acre. 1 N, 2 N, 5 O, and 5 A, each  $\frac{1}{11}$  acre. 6-1 and 6-2, each about  $\frac{1}{11}$  acre (0·137 acre). 7-1 and 7-2, each about  $\frac{1}{11}$  acre (0·118 acre).

The double lines indicate division paths between plot and plot. [For details of the manuring and produce, see pp. 26 and 27.]

(25)

#### RESULTS OF EXPERIMENTS MADE IN HOOS FIELD ON THE GROWTH OF

#### BARLEY,

for 47 years in succession on the same land—without manure, with Farmyard manure, and with various artificial manures.

The results show, that on the growth of Barley year after year on ordinary arable land, the produce by mineral manures alone is higher than that without manure; that nitrogenous manures alone give more produce than mineral manures alone; and that mixtures of both mineral and nitrogenous manures give much more than either used alone—indeed, generally twice, or more than twice, as much as mineral manures alone. Of mineral constituents, whether used alone or in mixture with nitrogenous manures, phosphates were much more effective than mixtures of salts of potash, soda, and magnesia. The averages show that, under all conditions of manuring (excepting with farmyard manure), the produce was less over the later than over the earlier periods of the experiments—a result partly due to the seasons. But the average produce for 40 years of continuous growth of Barley was, in all cases where nitrogenous and mineral manures (containing phosphates) were used together, much higher than the average produce of the crop grown in ordinary rotation in the United Kingdom; and very much higher than the average in most other countries when so grown.

Barley is appropriately sown in a lighter soil than Wheat; and whilst Wheat is usually sown in the autumn, Barley is as a rule sown in the spring; and hence it relies in a much greater degree on the stores of the surface soil. Accordingly, it is more susceptible to exhaustion of the surface-soil in nitrogenous, and especially in mineral supplies; and hence, in the common practice of agriculture, it more generally requires the direct application of mineral manures, especially phosphatic manures, than does Wheat when grown under equal soil conditions. The exhaustion induced by both crops is, however, characteristically that of available nitrogen; and when, under the ordinary conditions of manuring and cropping, artificial manure is still required, nitrogenous manures are as a rule requisite for both crops; and for the spring sown Barley more generally than for Wheat, phosphatic manures also. It is not recommended that Barley should in practice be grown year after year on the same land by artificial manures as in these experiments; but, in addition to the lighter soils on which it is more appropriately grown in ordinary rotation, it may be grown, both in full quantity per acre and of good quality, after Wheat, or other grain crop, on the heavier soils, when the land is clean enough for a second cereal crop.

For details of the manuring and produce of the different plots, see pages 26 and 27.

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HOOS

## EXPERIMENTS ON THE GROWTH OF BARLEY YEAR AFTER YEAR ON THE

Previous Cropping—1847, Swedish Turnips, with Dung and Superphosphate of Lime, the Roots carted off; 1848, Barley (with clover); 1849, Clover; 1850, Wheat; 1851, Barley manured with Amm.-salts. First Experimental Barley Crop in 1852. Barley every year since. The crop of the present year, 1898, is, therefore, the 47th Barley crop in succession. Unless stated to the contrary in the Table, or in the foot roots, the same Manura has been applied year after year to the same Plot. Description of in the foot-notes, the same Manure has been applied year after year to the same Plot. Description of (Area under experiment,

PLOTS.	1 acre        = (about)       0.404 Hectare        or 1.585 Prussian Morgen.         1 bushel        = (about)       0.364 Hectolitre        or 0.662 Prussian Scheffel.         1 lb. (pound avoir.)        = (about)       0.453 Kilogramme        or 0.907 Zollverein Pfund.         1 cwt. (hundredweight)       = (about)       50.8 Kilogrammes         or 1.016 Centner.         1 bushel per acre        = (about)       0.9 Hectolitre per Hectare       or 0.418 Pr. Scheffel per Pr. Morgen.         1 lb. per acre        = (about)       1.12       Kilogramme per Hectare       or 0.572 Zollv. Pfd. per Pr. Morgen.         1 cwt. per acre        = (about)       125.6       Kilogrammes per Hectare       or 0.641 Centner per Pr. Morgen.
n langt	Manures, per acre, per annum. [In 1898, 400 lbs. Basic Slag was used throughout instead of Superphosphate.]
1 O. 2 O. 3 O. 4 O.	Unmanured continuously 3½ cwts. Superphosphate of Lime (1) 200 lbs. (2) Sulphate Potash, 100 lbs. (3) Sulphate Soda, 100 lbs. Sulphate Magnesia 200 lbs. (2) Sulphate Potash, 100 lbs. (3) Sulphate Soda, 100 lbs. Sulphate Magnesia, 3½ cwts. Superphosphate
1 A. 2 A. 3 A. 4 A.	200 lbs. Ammonium-salts (4) 200 lbs. Ammonium-salts, and 3½ cwts. Superphosphate 200 lbs. Ammonium-salts, 200 lbs. (2) Sulph. Potash, 100 lbs. (3) Sulph. Soda, 100 lbs. Sulph. Magnesia (200 lbs. Ammonium-salts, 200 lbs. (2) Sulph. Potash, 100 lbs. (3) Sulph. Soda, 100 lbs. Sulph. Magnesia, 3½ cwts. Superphosphate
$\begin{cases} 1 & AA. \\ 2 & AA. \\ 3 & AA. \\ 4 & AA. \end{cases}$	275 lbs. Nitrate Soda.  275 lbs. Nitrate Soda, and 3½ cwts. Superphosphate  275 lbs. Nitrate Soda, 200 lbs. © Sulph. Potash, 100 lbs. © Sulph. Soda, 100 lbs. Sulph. Magnesia  (275 lbs. Nitrate Soda, 200 lbs. © Sulph. Potash, 100 lbs. © Sulph. Soda, 100 lbs. Sulph. Magnesia, 3½ cwts. Superphosphate
$\begin{cases} 1 & \text{AAS.} \\ 2 & \text{AAS.} \\ 3 & \text{AAS.} \\ 4 & \text{AAS.} \end{cases}$	275 lbs. Nitrate Soda, 400 lbs. Silicate Soda, and 3½ cwts Superphosphate (1) 275 lbs. Nitrate Soda, 400 lbs. Silicate Soda, and 3½ cwts Superphosphate (1) (275 lbs. Nitrate Soda, 400 lbs. Silicate Soda, 200 lbs. (2) Sulph. Potash, 100 lbs. (3) Sulph. Soda, 100 lbs. Sulph. Magnesia (275 lbs. Nitrate Soda, 400 lbs. Silicate Soda, 200 lbs. (2) Sulph. Potash, 100 lbs. (3) Sulph. Soda, 100 lbs. Sulph. Magnesia, and 3½ cwts. Superphosphate
$0 = \begin{cases} 1 & \text{O.} \\ 2 & \text{C.} \\ 3 & \text{C.} \\ 4 & \text{O.} \end{cases}$	1000 lbs. Rape-cake
${1 \choose 2}$ ${1 \choose N}$ .	275 lbs. Nitrate Soda
5 O. 5 A. M.	200 lbs. (2) Sulphate Potash, 3½ cwts. Superphosphate (10)
$6{1 \choose 2}$	Unmanured continuously
$7igl\{12$	Farmyard Manure 14 tons, 20 yrs., 1852-71; unmanured since

(a) The application of Silicates did not commence until 1864; in 1864-5-6 and 7, 200 lbs. Silicate of Soda and 200 lbs.

<sup>(1) &</sup>quot;Superphosphate of Lime," 1852 to 1887 inclusive, made from 200 lbs. Bone-ash, 150 lbs. Sulphuric acid, sp. gr. 1.7 (and water); 1888, and since, made from high percentage mineral phosphates, and containing 37 per cent., or more, of soluble phosphate.
(2) 300 lbs. per annum for the first six years, 1852-7.
(3) 200 lbs. per annum for the first six years, 1852-7.
(4) The "Ammonium-salts"—in all cases (excepting in 1887), equal parts Sulphate and Muriate of Ammonia of Commerce.
In 1887 Sulphate Ammonia only, 225 lbs. per acre, equal in Nitrogen to the "Ammonium-salts" of previous years.
(5) First 6 years, 1852-7, instead of Nitrate of Soda, 400 lbs. Ammonium-salts per annum; next 10 years, 1858-67, 200 lbs. Ammonium-salts per annum; 1868, and since, 275 lbs. Nitrate of Soda per annum. 275 lbs. Nitrate of Soda is reckoned to contain the same amount of Nitrogen as 200 lbs. "Ammonium-salts."
(6) The application of Silicates did not commence until 1864: in 1864-5-6 and 7, 200 lbs. Silicate of Soda and 200 lbs.

FIELD.

SAME LAND, WITHOUT MANURE, AND WITH DIFFERENT DESCRIPTIONS OF MANURE.

Barley—29 years, 1852–1880, Chevalier; 10 years, 1881–1890, Archer's Stiff Straw; 7 years, 1891–1897, Carter's Paris Prize; 1898, Archer's Stiff Straw. In the spring of 1894 permanent division paths were laid out between plot and plot. Below is given, besides the usual averages, the produce for both 1896

For Plan of the Plots, and brief summary of results and conclusions, see pp. 24-25. about 41 acres.)

Plots.	Dressed Grain.															
	Quantity.					Weight per Bushel.					Total Straw.					PLOTS
					46th	Averages.			45th	46th	Averages.			46th	46th	-
	22 Yrs. 1852-73.	22 Yrs. 1874–95		Year, 1896.	Year, 1897.	22 Yrs. 1852-73.	22 Yrs. 1874-95		Year, 1896.	Year, 1897.	22 Yrs. 1852-73.		44 Yrs. 1852-95.	Year, 1896.	Year, 1897.	
1 O. 2 O. 3 O. 4 O.	Bush. $19\frac{1}{4}$ $24\frac{7}{8}$ $21\frac{1}{2}$ $26\frac{1}{2}$	Bush. 13 17½ 13½ 13,0	Bush. 16½ 21¼ 17½ 21¼	Bush. 113 137 11 141 141	Bush. 5 61 3 51	1bs. 528 534 534 532	1bs. 52 534 528 527	$\begin{array}{c} \text{lbs.} \\ 52\frac{1}{8} \\ 53\frac{1}{4} \\ 52\frac{5}{8} \\ 53\frac{1}{8} \end{array}$	1bs. 54 54 54 544 544	1bs. 48 504 494 504	Cwts. 11½ 12¾ 11¾ 11¾ 1378	Cwts. 7 8½ 7½ 8½ 8½ 8½	Cwts. 91 103 93 111	Cwts. 8 814 712 85	Cwts. $5\frac{1}{8}$ $5\frac{3}{4}$ 4 $5\frac{1}{2}$	1 O. 2 O. 3 O. 4 O.
A. 2 A. 3 A.	32½ 467 34¾	237 37 263	28 42 303	$14\frac{1}{4}$ $20\frac{1}{4}$ $21$	$12 \\ 16 \\ 17\frac{1}{2}$	52½ 53½ 52%	52½ 52½ 52¾ 52¾	52½ 52½ 52¾	53 <u>4</u> 50 <u>4</u> 54	47 47 49 49	$   \begin{array}{r}     18\frac{1}{4} \\     27\frac{1}{4} \\     20\frac{3}{8}   \end{array} $	12 <del>7</del> 19 <del>8</del> 147	15½ 23§ 17§	10½ 14½ 14½	117 155 143	1 A. 2 A. 3 A.
A.	457	41	431	414	30½	54	541	. 54 <sub>3</sub>	$54\frac{3}{4}$	513	281	$23\frac{1}{8}$	255	$21\frac{1}{8}$	213	4 A.
AA. BAA. BAA.	36½ 48¾ 36%	$27\frac{1}{4}$ $42$ $28\frac{1}{2}$	317 458 328	$21\frac{1}{4}$ $37\frac{2}{4}$ $25\frac{1}{4}$	$17\frac{1}{9}$ $32\frac{3}{4}$ $21\frac{1}{4}$	52 <del>1</del> 53 <del>8</del> 52 <del>1</del>	52½ 53½ 52%	52½ 53§ 52§	52 <del>5</del> 54 <del>8</del> 53 <del>2</del>	49½ 51½ 51½	$21\frac{5}{8}$ $30$ $23\frac{3}{8}$	158 238 178	18 <u>1</u> 26 <u>5</u> 20 <del>1</del>	$17\frac{3}{8}$ $20\frac{1}{2}$ $18\frac{1}{8}$	14 <u>1</u> 24 <u>1</u> 18§	1 AA 2 AA 3 AA
AA.	484	411	45	35	301	$53\frac{1}{2}$	54 <del>1</del>	533	545	515	313	24 <sub>8</sub>	281	221	231	4 AA
AAS.	37½ 47½	33 <u>3</u> 44 <u>1</u>	347 45}	33 39	$24\frac{5}{8}$ $31\frac{1}{4}$	54 <u>4</u> 55 <u>4</u>	53½ 54	(53 <del>2</del> 54 <u>1</u>	535 551	51½ 51¾	215 283 284	19 <del>1</del> 25 <del>1</del>	(19 <u>1</u>   26 <u>1</u>	207 223 228	21½ 27½	1 AA
AAS.	42	36 <u>‡</u>	(12){38	36	$24\frac{1}{8}$	547	54	(12) 544	54 <u>3</u>	$52\frac{1}{8}$	25	207	$(^{12})\{22\frac{1}{4}$	$22_{8}^{5}$	197	3 A.A
AAS.	487	45	461	41½	30	55 <del>8</del>	54 <del>8</del>	54%	55½	52g	303	$27\frac{3}{4}$	288	$23\frac{1}{8}$	$22\frac{5}{8}$	4 A.A
C. C. C.	$44\frac{5}{8}$ $46\frac{1}{4}$ $43$	$36\frac{1}{2}$ $39\frac{1}{2}$ $35\frac{1}{4}$	405 427 39	368 404 324	26 31 25 25	53¾ 53¾ 53¾	54 <del>1</del> 54 <u>1</u> 54 <u>1</u> 54 <u>1</u>	537 541 54	55½ 55½ 54½	51½ 52½ 51¾	$26\frac{1}{4}$ $27\frac{3}{4}$ $26\frac{3}{8}$	$20 \\ 21\frac{1}{2} \\ 20$	23½ 24½ 23½	19½ 20½ 18¾	$20\frac{1}{4}$	1 C. 2 C. 3 C.
C.	463	381	$42\frac{1}{2}$	371	298	53 <del>5</del>	548	54	56	52	287	217	253	201		4 C.
N. N.	37§ 41§	30§ 35	(13){34 38	$30\frac{3}{4} \\ 36\frac{1}{2}$	$15^{3}_{8} \\ 23^{1}_{2}$	52 <del>2</del> 52 <del>2</del>	527 531	$\binom{13}{53}$ $\binom{52\frac{3}{4}}{53}$	55 <del>8</del> 56 <del>8</del>	49 <u>4</u> 50 <u>4</u>	$22rac{3}{4}$ $25rac{5}{8}$	17½ 20½	$\binom{13}{22_8^7}$	$18\frac{3}{4}$ $22\frac{1}{4}$		1 N. 2 N.
O. A. M.	$   \begin{array}{c c}     22 \\     43\frac{3}{4} \\     20   \end{array} $	14 <del>2</del> 33 <del>2</del> 18 <u>2</u>	$\binom{13}{38\frac{3}{4}}$ $\binom{14}{19\frac{1}{4}}$	135 31 <del>3</del> (15)	58 178 (15)	53½ 53¼ 53½		(13){533 537 (14) 533	$55\frac{1}{8}$ $56\frac{5}{8}$ $(^{15})$	$49\frac{1}{8}$ $52\frac{1}{4}$ $\binom{15}{1}$	$11rac{7}{8}$ $27rac{5}{8}$ $11rac{3}{4}$	$8\frac{1}{4}$ $20\frac{7}{8}$ $9\frac{7}{8}$	$(^{13}){10 \atop 241 \atop 8} (^{14}) 103 \atop 103 $	$9\frac{7}{8}$ $18\frac{3}{6}$ $\binom{15}{}$	6 15 (15)	5 O. 5 A. M.
$6{1 \choose 2}$	21½ 21¾	$14\frac{1}{2}$ $15\frac{3}{4}$	173 181	$12\frac{5}{8}$ $13\frac{3}{8}$	2 <u>3</u> 4 <u>3</u>	$52\frac{1}{2}$ $52\frac{3}{4}$	$52\frac{1}{2}$ $52\frac{1}{2}$	52½ 52§	53‡ 54¦	497 497	117 113	7 <u>3</u> 8	97 92	8 <del>7</del> 8 <del>7</del> 8 <del>7</del>	53 53	${1 \choose 2} 6$
$7{1 \choose 2}$	47 <del>2</del> 48 <del>1</del>	28½ 49½	38 48‡	22½ 533	127 42	54½ 54½	54 54 <del>8</del>	541 542	55½ 54¾	51 <del>2</del> 53 <del>2</del>	$27\frac{3}{4}$ $28\frac{1}{4}$	15 <sup>3</sup> / <sub>4</sub> 30 <sup>1</sup> / <sub>8</sub>	214 298	148 278	11 295	${1 \choose 2} 7$

Silicate of Lime were applied per acre, but in 1868, and since, 400 lbs. Silicate of Soda, and no Silicate of Lime. These plots ("AAS") comprise, respectively, one half of the original "AA" plots, and, excepting the addition of the Silicates, have been, and are, in other respects, manured in the same way as the "AA" plots.

(7) 2000 lbs. Rape-cake per annum for the first six years, and 1000 lbs. only, each year since.

(8) 300 lbs. Sulphate of Potash, and 3½ cwts. Superphosphate of Lime, without Nitrate of Soda, the first year (1852); Nitrate alone each year since.

(9) 550 lbs. Nitrate of Soda for 1853-4-5-6, and 7; and 275 lbs. only, each year since.

(10) Ammonium-salts also the first year, but not since.

(11) By mistake 400 lbs. in 1880.

(12) Averages of 10, 22, and 32 years, 1864-95.

(13) Averages of 21, 22, and 43 years, 1853-95.

(14) Averages of 16, 18, and 34 years, 1858-78, and 1880-92.

The produce of 1879 was not weighed, owing to the foulness of the plot, from the wet season.

(15) Not recorded.