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RESEARCH

# Yields of the Field Experiments 1898

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## Barley; Hoos Field

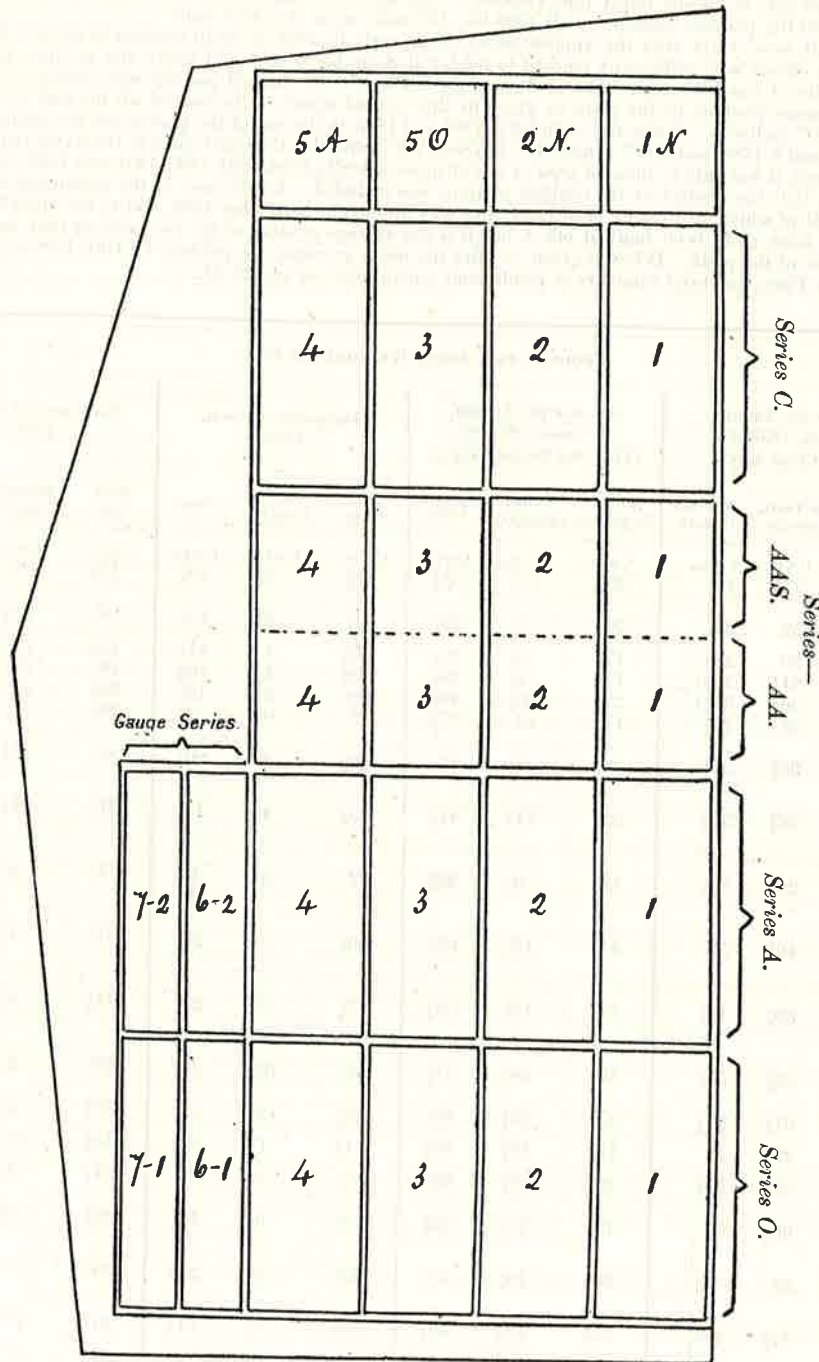
### Rothamsted Research

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PLAN OF THE PLOTS IN HOOS FIELD,  
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  $\frac{2}{11}$  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  $\frac{1}{2}$  acre (0.137 acre).  
7-1 and 7-2, each about  $\frac{1}{2}$  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.]

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.



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-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 avoird.) .. = (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.		
	Manures, per acre, per annum. [In 1898, 400 lbs. Basic Slag was used throughout instead of Superphosphate.]	
1 O.	Unmanured continuously .. .. .	
2 O.	3½ cwt. Superphosphate of Lime <sup>(1)</sup> .. .. .	
3 O.	200 lbs. <sup>(2)</sup> Sulphate Potash, 100 lbs. <sup>(3)</sup> Sulphate Soda, 100 lbs. Sulphate Magnesia .. .. .	
4 O.	200 lbs. <sup>(2)</sup> Sulphate Potash, 100 lbs. <sup>(3)</sup> Sulphate Soda, 100 lbs. Sulphate Magnesia, 3½ cwt. Superphosphate .. .. .	
1 A.	200 lbs. Ammonium-salts <sup>(4)</sup> .. .. .	
2 A.	200 lbs. Ammonium-salts, and 3½ cwt. Superphosphate .. .. .	
3 A.	200 lbs. Ammonium-salts, 200 lbs. <sup>(2)</sup> Sulph. Potash, 100 lbs. <sup>(3)</sup> Sulph. Soda, 100 lbs. Sulph. Magnesia .. .. .	
4 A.	{ 200 lbs. Ammonium-salts, 200 lbs. <sup>(2)</sup> Sulph. Potash, 100 lbs. <sup>(3)</sup> Sulph. Soda, 100 lbs. Sulph. Magnesia, } 3½ cwt. Superphosphate .. .. .	
1 AA.	275 lbs. Nitrate Soda .. .. .	
2 AA.	275 lbs. Nitrate Soda, and 3½ cwt. Superphosphate .. .. .	
3 AA.	275 lbs. Nitrate Soda, 200 lbs. <sup>(2)</sup> Sulph. Potash, 100 lbs. <sup>(3)</sup> Sulph. Soda, 100 lbs. Sulph. Magnesia .. .. .	
4 AA.	{ 275 lbs. Nitrate Soda, 200 lbs. <sup>(2)</sup> Sulph. Potash, 100 lbs. <sup>(3)</sup> Sulph. Soda, 100 lbs. Sulph. Magnesia, } 3½ cwt. Superphosphate .. .. .	
1 AAS.	275 lbs. Nitrate Soda, 400 lbs. Silicate Soda <sup>(5)</sup> .. .. .	
2 AAS.	275 lbs. Nitrate Soda, 400 lbs. Silicate Soda, and 3½ cwt. Superphosphate <sup>(1)</sup> .. .. .	
3 AAS.	{ 275 lbs. Nitrate Soda, 400 lbs. Silicate Soda, 200 lbs. <sup>(2)</sup> Sulph. Potash, 100 lbs. <sup>(3)</sup> Sulph. Soda, 100 lbs. } Sulph. Magnesia .. .. .	
4 AAS.	{ 275 lbs. Nitrate Soda, 400 lbs. Silicate Soda, 200 lbs. <sup>(2)</sup> Sulph. Potash, 100 lbs. <sup>(3)</sup> Sulph. Soda, 100 lbs. } Sulph. Magnesia, and 3½ cwt. Superphosphate .. .. .	
1 C.	1000 lbs. Rape-cake .. .. .	
2 C.	1000 lbs. Rape-cake, and 3½ cwt. Superphosphate .. .. .	
3 C.	1000 lbs. Rape-cake, 200 lbs. <sup>(2)</sup> Sulph. Potash, 100 lbs. <sup>(3)</sup> Sulph. Soda, 100 lbs. Sulph. Magnesia .. .. .	
4 C.	{ 1000 lbs. Rape-cake, 200 lbs. <sup>(2)</sup> Sulph. Potash, 100 lbs. <sup>(3)</sup> Sulph. Soda, 100 lbs. Sulph. Magnesia, } 3½ cwt. Superphosphate .. .. .	
1 N.	275 lbs. Nitrate Soda .. .. .	
2 N.	275 lbs. <sup>(9)</sup> Nitrate Soda .. .. .	
5 O.	200 lbs. <sup>(2)</sup> Sulphate Potash, 3½ cwt. Superphosphate <sup>(10)</sup> .. .. .	
5 A.	200 lbs. <sup>(2)</sup> Sulphate Potash, 3½ cwt. Superphosphate, and 200 lbs. <sup>(11)</sup> Ammonium-salts .. .. .	
M.	100 lbs. Sulphate Soda, 100 lbs. Sulphate Magnesia, and 3½ cwt. Superphosphate .. .. .	
6{1	Unmanured continuously .. .. .	
2	Ashes (burnt soil and turf) .. .. .	
7{1	Farmyard Manure 14 tons, 20 yrs., 1852-71; unmanured since .. .. .	
2	Farmyard Manure 14 tons, every year .. .. .	

(1) "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 and 1897.

For Plan of the Plots, and brief summary of results and conclusions, see pp. 24–25. about 4½ acres.)

PLOTS.	PRODUCE PER ACRE.															PLOTS.
	Dressed Grain.										Total Straw.					
	Quantity.					Weight per Bushel.					Averages.					
	Averages.			46th Year, 1896.	46th Year, 1897.	Averages.			46th Year, 1896.	46th Year, 1897.	Averages.			46th Year, 1896.	46th Year, 1897.	
	22 Yrs. 1852-73.	22 Yrs. 1874-95.	44 Yrs. 1852-95.			22 Yrs. 1852-73.	22 Yrs. 1874-95.	44 Yrs. 1852-95.			22 Yrs. 1852-73.	22 Yrs. 1874-95.	44 Yrs. 1852-95.			
Bush.	Bush.	Bush.	Bush.	Bush.	lbs.	lbs.	lbs.	lbs.	lbs.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.		
1 O.	19½	13	16½	11½	5	52½	52	52½	54	48	11½	7	9½	8	5½	
2 O.	24½	17½	21½	13½	6½	53½	53½	53½	54	50½	12½	8½	10½	8½	5½	
3 O.	21½	13½	17½	11	3	53½	52½	52½	54½	49½	11½	7½	9½	7½	4	
4 O.	20½	17	21½	14½	5½	53½	52½	53½	54½	50½	13½	8½	11½	8½	5½	
1 A.	32½	28½	28	14½	12	52½	52½	52½	53½	47	18½	12½	15½	10½	11½	
2 A.	46½	37	42	20½	16	53½	52½	52½	50½	47½	27½	19½	23½	14½	15½	
3 A.	34½	26½	30½	21	17½	52½	52½	52½	54	49½	20½	14½	17½	14½	14½	
4 A.	45½	41	43½	41½	30½	54	54½	54½	54½	51½	28½	23½	25½	21½	21½	
1 AA.	36½	27½	31½	21½	17½	52½	52½	52½	52½	49½	21½	15½	18½	17½	14½	
2 AA.	48½	42	45½	37½	32½	53½	53½	53½	54½	51½	30	23½	26½	20½	24½	
3 AA.	36½	28½	32½	25½	21½	52½	52½	52½	53½	51½	23½	17½	20½	18½	18½	
4 AA.	48½	41½	45	35	30½	53½	54½	53½	54½	51½	31½	24½	28½	22½	23½	
1 AAS.	37½	33½	34½	33	24½	54½	53½	53½	53½	51½	21½	19½	19½	20½	21½	
2 AAS.	47½	44½	45½	39	31½	55½	54	54½	55½	51½	28½	25½	26½	22½	27½	
3 AAS.	42	36½	(12) 38	36	24½	54½	54	(12) 54½	54½	52½	25	20½	(12) 22½	22½	19½	
4 AAS.	48½	45	46½	41½	30	55½	54½	54½	55½	52½	30½	27½	28½	23½	22½	
1 C.	44½	36½	40½	36½	26½	53½	54½	53½	55½	51½	26½	20	23½	19½	18½	
2 C.	46½	39½	42½	40½	31½	53½	54½	54½	55½	52½	27½	21½	24½	20½	20½	
2 C.	43	35½	39	32½	25½	53½	54½	54	54½	51½	26½	20	23½	18½	16½	
4 C.	46½	38½	42½	37½	29½	53½	54½	54	56	52	28½	21½	25½	20½	19½	
1 N.	37½	30½	(13) 34	30½	15½	52½	52½	(13) 52½	55½	49½	22½	17½	(13) 19½	18½	17½	
2 N.	41½	35	(13) 38	36½	23½	52½	53½	(13) 53	56½	50½	25½	20½	(13) 22½	22½	20½	
5 O.	22	14½	(13) 18½	13½	5	53½	53½	(13) 53½	55½	49½	11½	8½	(13) 10	9½	6	
5 A.	43½	33½	(13) 38½	31½	17½	53½	53½	(13) 53½	56½	52½	27½	20½	(13) 24½	18½	15	
M.	20	18½	(14) 19½	(15)	(15)	53½	53½	(14) 53½	(15)	(15)	11½	9½	(14) 10½	(15)	(15)	
6(1	21½	14½	17½	12½	2½	52½	52½	52½	53½	49½	11½	7½	9½	8½	5½	
2	21½	15½	18½	13½	4½	52½	52½	52½	54½	49½	11½	8	9½	8½	5½	
7(1	47½	28½	38	22½	12½	54½	54	54½	55½	51½	27½	15½	21½	14½	11	
2	48½	49½	48½	53½	42	54½	54½	54½	54½	53½	28½	30½	29½	27½	29½	

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 cwt. 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.