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RESEARCH

## Report for 1929

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## The Classical Experiments

### Rothamsted Research

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DATES OF SOWING AND HARVESTING, AND YIELD PER ACRE, 1929.

Field.	Crop.	Variety.	Principal Cultivations and Dates.	Manuring. cwt. per acre.	Sowing Dates.	Cutting Dates.	Carting Dates.	Yield per acre.
Great Harpenden	Wheat	Million III...	After Potatoes ploughed, Oct. 25-27. Nov. 2-3 harrowed and drilled then harrowed in .. After Beet ploughed, Nov. 8-12, harrowed, drilled, then harrowed .. .. . Mar. 8-12, ploughed and harrowed and cultivated.	1½ S/Amm.	Nov. 2-3			
	Barley	Standwell ..	.. .. . Mar. 21, horse rolled .. .. .	1 S/Amm. 1 M/Pot. 2 Super. . . . 1 Nitro-Chalk ..	Nov. 14 (grass Apr. 18) Mar. 15 (grass Apr. 4)	Aug. 16-17 Aug. 12 ..	Aug. 22-23 Aug. 20 ..	7 qrs. see pp. 97-8
	Grass	.. .. .	Tractor sub-soiled Sept. 10. Sept. 19, Tractor harrowed and rolled. Mar. 20-21, horse rolled. Apr. 2-4, harrowed and rolled.	2 S/Amm. 2½ Super. 1 M/Pot. . . .	Aug. 24 (1928) Sept. 20 (1928) Mar. 29 (Spring oats) Apr. 2. .. (Barley)	Aug. 7 .. Aug. 13 ..	Aug. 19-20 Aug. 27-28	— 5½ qrs.
Pastures	Winter Oats patched with Spring Oats and Barley	Grey Victory Standwell ..	Ploughed Sept, 1929.	15-16 tons dung ..	Sept. 24-25, 1929 .. .	For sheep feed in Spring.		
	Forage Mixture	1 bush. Beans, 1 bush. Tares, 3 bush. Winter Oats (rate 3 bush. per acre)						
Little Hoos	Wheat	Million III ..	Oct. 22-24, tractor ploughed and harrowed. Oct. 26, harrowed in. Mar. 20-21, horse rolled. . . . Tractor ploughed, horse harrowed and rolled. Bouted May 2 and 3, ridges split .. .. . April 16-17, tractor rolled .. .. . Ploughed up July 4-15 .. .. . Cultivated July 24 .. .. .	2 Super. 1½ S/Amm. 1 M/Pot. . . . 15 tons "Adco" .. 2½ Super. 1½ S/Amm. 1 M/Pot. . . .	Oct. 25 (1928) May 28 (1st sowing, May 9, destroyed by fly)	Aug. 16 .. —	Aug. 21-22 Nov. 16-21	6½ qrs. 15 tons
Broadbalk Acre	Swedes	Garton's Magnificent						
Fosters	1 Year's Seeds	.. .. .	April 6, drilled and harrowed in. Apr. 8 rolled. Ploughed up July 24	ditto ..	Sept. 10 (failed) resown Apr. 6, 1929 .. .	June 22 .. July 13 ..	July 1-2 .. July 23 ..	38 cwts. 2 tons.
	3½ acres Italian rye grass and trifolium killed by frost replaced by forage mixture	1 bush. beans 1 bush. peas 2 bush. spring oats (rate 4 bush. per acre)						

**DATES OF SOWING AND HARVESTING AND YIELD PER ACRE, 1929.**

Field.	Crop.	Variety.	Principal Cultivations and Dates.	Manuring. cwt. per acre.	Sowing Dates.	Cutting Dates.	Carting Dates.	Yield per acre.
Great Knott	Mustard ..		Mar. 14-21, tractor ploughed. Apr. 16, Mustard sown and harrowed in by tractor. June 22-29 ploughed in by tractor, twice disc scarified (June 29, Aug. 1) (Aug. 28) see p. 99 .. .. see p. 93 .. ..	25 tons St. Albans town refuse	Apr. 16	—	—	—
Long Hoos 1	Potatoes ..	Ally ..	.. ..	—	—	—	—	see p. 99
2	Winter Oats	Grey ..	.. ..	—	—	—	—	see p. 93
3	1 Year's Seeds		.. ..	—	—	—	—	—
4	Barley ..	Spratt Archer.. Plumage Archer	.. ..	—	—	—	—	—
5	Sugar Beet ..	—	.. ..	—	—	—	—	see p. 89
6	Wheat ..	—	.. ..	—	—	—	—	see p. 102
Great Field	Grazing ..	—	May 23, tractor rolled and light harrowed .. ..	—	—	June 28-29 grass cut after grazing	July 8 ..	12-15 cwt.
Little Knott	½ pig grazing / ½ hay after early grazing / Grazing ..	—	Nov. 24, chain harrowed ..	1 acre had 2 Super., 2 M/ Pot., 1 S/Am.	—	—	July 8-9	20 cwt.
New Zealand		—	Apr. 16, seeds harrowed in (tractor) and horse rolled .. ..	6 Basic Slag 6 Slag .. 8 tons F.Y.M.	Sept. 4 (1928) Apr. 16 ..	—	—	—
Stackyard ..	Cut for Hay after grazing Grazing ..	—	Apr. 18, tractor rolled .. ..	—	—	—	—	12-15 cwt.
Sawyers * ..		—	—	—	—	—	—	—
Outer Great Knott ..	Grazing ..	—	Apr. 16 tractor rolled .. ..	—	—	—	—	—
West Barnfield Fosters Corners ..	—	—	Apr. 17, tractor rolled .. ..	6 Slag ..	Aug. 29 (1928)	—	—	—
Broadbalk ..	Wheat ..	Square-Head's Master ..	Apr. 17, tractor rolled .. ..	6 Slag ..	—	—	—	—
Hoos ..	Barley ..	Plumage Archer Spratt Archer ..	—	—	Oct. 9 (1928)	Aug. 9	Aug. 17	see p. 87
Barnfield ..	Mangolds ..	Prize Winner .. Yellow Globe .. Plumage Archer	—	—	Apr. 17-18 Apr. 24-27	Aug. 29-30	Sept. 4-5 Oct. 16-30	see p. 88 see p. 85
Agdell Park ..	Barley .. Hay ..	—	—	—	Mar. 15	Aug. 19 July 1-6	Aug. 26 July 10-11	see p. 84 see p. 86

\* 4 acres sown with Barley and undersown with Grass. Yield 8 qrs.

## CROP YIELDS ON THE EXPERIMENTAL PLOTS.

NOTES.—In each case the year refers to the harvest, *e.g.*, Wheat 1929 means wheat harvested in 1929. In the tables, total straw includes straw, cavings and chaff. These were weighed separately prior to 1928. Since 1928 the figure given as total straw has been arrived at as the difference : total sheaf weight—weight of grain.

CONVERSION TABLE.

1 acre .. .. =	0.405 Hectare .. ..	0.963 Feddan.
1 bushel (Imperial) =	0.364 Hectolitre (36.364 litres)	0.184 Ardeb.
1 lb. (pound avoirdupois) =	0.453 Kilogramme .. ..	1.009 Rotls.
1 cwt. (hundredweight, 112 lb.) .. .. =	50.8 Kilogrammes .. ..	{ 113.0 Rotls.
1 ton (20 cwt. or 2240 lb.) =	1016 Kilogrammes	{ 1.366 Maunds.
1 metric quintal or Doppel Zentner (dz) .. =	100.0 Kilogrammes	
	220.46 lb.	
1 bushel per acre .. =	0.9 Hectolitre per Hectare ..	0.191 Ardeb per Feddan
1 lb. per acre .. =	1.12 Kilogramme per Hectare ..	1.049 Rotls per Feddan
1 cwt. per acre .. =	1.256 dz. per Hectare .. ..	117.4 Rotls per Feddan
1 ton per acre .. =	25.12 dz. per Hectare	
1 dz. per Hectare .. =	0.796 cwt. per acre	

In America the Winchester bushel is used = 35.236 litres. 1 English bushel = 1.032 American bushels.

CONVERSION TABLE.—CWT. TO BUSHEL.

Crop.	Cwt.									
	1	2	3	4	5	10	15	20	25	30
Wheat (60 lb.) bushels	1.87	3.73	5.60	7.47	9.33	18.67	28.00	37.33	46.67	56.00
Barley (52 lb.) ..	2.15	4.31	6.46	8.62	10.77	21.54	32.31	43.08	53.85	64.62
Oats (42 lb.) ..	2.67	5.33	8.00	10.67	13.33	26.67	40.00	53.33	66.67	80.00

The yields of grain in the 1925-26 Report were given for the Replicated Experiments in standard bushels of 60, 52 and 42 lb. respectively.

Average Wheat Yield of Various Countries.

Country.	Mean yield per acre, 1919-27. cwt.	Country.	Mean yield per acre, 1919-27. cwt.
Great Britain .. ..	17.4	Denmark .. ..	22.5
England .. ..	17.3	Argentina .. ..	6.6
Hertfordshire .. ..	16.3	Australia .. ..	6.6
France .. ..	10.8	Canada .. ..	8.6
Germany .. ..	14.1	United States .. ..	7.5
Belgium .. ..	20.0	U.R.S.S. (Europe and Asia) *	5.7

NOTE.—Figures for Great Britain, England and Hertfordshire are taken from the Ministry of Agriculture's "Agricultural Statistics," Vol 62. Other figures from "International Year Book of Agricultural Statistics," 1922-28.

\*1924-27.

### METEOROLOGICAL RECORDS, 1929.

	Rain.		Drainage through soil.			Bright Sun- shine.	Temperature (Mean).				
	Total Fall 1/1000th Acre Gauge.	No. of Rainy Days (0.01 inch or more) 1/1000th Acre Gauge.	20 ins. deep.	40 ins. deep.	60 ins. deep.		Max.	Min.	1 ft. in ground.	Solar Max.	Grass Min.
1929.	Inches.	No.	Inches.	Inches.	Inches.	Hours.	°F.	°F.	°F.	°F.	°F.
Jan. ..	1.759	16	1.154	1.378	1.220	39.5	36.2	30.0	34.4	53.3	27.1
Feb. ..	0.789	8	0.708	1.006	0.931	67.2	35.5	25.9	33.8	70.3	21.0
Mar. ..	0.065	2	0.000	0.017	0.013	184.7	53.2	32.5	37.2	99.1	26.4
April. .	1.613	12	0.140	0.240	0.217	155.1	50.6	35.6	43.3	102.4	30.9
May ..	3.065	13	0.852	1.101	1.017	261.0	60.4	42.7	50.8	119.9	37.7
June ..	1.023	11	0.002	0.030	0.031	226.5	63.7	48.3	57.4	124.8	43.9
July ..	1.417	10	0.001	0.006	0.006	243.7	70.8	51.9	61.5	129.4	47.1
Aug. ..	0.633	12	0.000	0.000	0.000	196.7	69.2	51.5	60.4	126.1	46.7
Sept. .	0.246	2	0.000	0.000	0.000	206.0	72.0	52.0	61.0	119.9	46.4
Oct. ..	4.516	15	1.895	1.891	1.343	120.1	55.7	42.3	50.4	98.9	38.1
Nov. ..	6.561	20	5.931	6.093	5.790	78.0	48.8	37.5	42.9	79.8	33.1
Dec. ..	6.018	22	5.559	5.780	5.490	75.3	46.3	36.4	40.8	71.7	32.3
Total or Mean	27.705	143	16.242	17.542	16.058	1853.8	55.2	40.6	47.8	99.6	35.9

### RAIN AND DRAINAGE. MONTHLY MEAN FOR 59 HARVEST YEARS, 1870-1—1928-9.

	Rain- fall.	Drainage.			Drainage % of Rainfall.			Evaporation.		
		20-in. Gauge.	40-in. Gauge.	60-in. Gauge.	20-in. Gauge.	40-in. Gauge.	60-in. Gauge.	20-in. Gauge.	40-in. Gauge.	60-in. Gauge.
Sept. ..	Ins.	Ins.	Ins.	Ins.	%	%	%	Ins.	Ins.	Ins.
Sept. ..	2.398	0.818	0.792	0.729	34.1	33.0	30.4	1.580	1.606	1.669
Oct. ..	3.148	1.817	1.784	1.658	57.7	56.7	52.7	1.331	1.364	1.490
Nov. ..	2.781	2.104	2.158	2.031	75.7	77.6	73.0	0.677	0.623	0.750
Dec. ..	2.818	2.397	2.496	2.382	85.1	88.6	84.5	0.421	0.322	0.436
Jan. ..	2.408	1.970	2.168	2.068	81.8	90.0	85.9	0.438	0.240	0.340
Feb. ..	2.051	1.532	1.645	1.571	74.7	80.2	76.6	0.519	0.406	0.480
March ..	2.007	1.070	1.200	1.135	53.3	59.8	56.6	0.937	0.807	0.872
April ..	2.023	0.655	0.735	0.699	32.4	36.3	34.6	1.368	1.288	1.324
May ..	2.046	0.475	0.544	0.510	23.2	26.6	24.9	1.571	1.502	1.536
June ..	2.246	0.547	0.576	0.555	24.4	25.6	24.7	1.699	1.670	1.691
July ..	2.725	0.725	0.753	0.700	26.6	27.6	25.7	2.000	1.972	2.025
Aug. ..	2.648	0.703	0.716	0.672	26.5	27.0	25.4	1.945	1.932	1.976
Year ..	29.299	14.813	15.567	14.710	50.6	53.1	50.2	14.486	13.732	14.589

Area of each gauge 1/1000th acre.

### CHEMICAL ANALYSES OF FERTILISERS USED IN REPLICATED EXPERIMENTS.

Fertiliser.	% N	% water-sol. P <sub>2</sub> O <sub>5</sub>	% K <sub>2</sub> O	% Cl.
Sulphate of Ammonia .. ..	20.7-21.2	—	—	—
Muriate of Ammonia .. ..	26.0	—	—	—
Nitrate of Soda .. ..	15.0	—	—	—
Urea .. ..	45.8	—	—	—
Cyanamide .. ..	21.0-21.3	—	—	—
Ammonium Phosphate .. ..	12.2	61.6	—	—
Superphosphate .. ..	—	16.5	—	—
Potassium Phosphate (K <sub>2</sub> HPO <sub>4</sub> ) .. ..	—	40.8	54.0	—
Sulphate of Potash .. ..	—	—	50.8	—
Muriate of Potash .. ..	—	—	52.6	48.8
Potash Manure Salts (30%) .. ..	—	—	31.9	50.9
Potash Manure Salts (20%) .. ..	—	—	17.7	46.6
Potash Mineral .. ..	—	—	16.2	—
Agricultural Salt .. ..	—	—	—	57.2

FIRST SERIES : CLASSICAL EXPERIMENTS OF  
LAWES AND GILBERT.  
CROPS GROWN IN ROTATION.  
AGDELL FIELD.

PRODUCE PER ACRE.

Year.	Crop.	O. Unmanured since 1848.		M. Mineral Manure† No Nitrogen.		C. Complete Mineral‡ and Nitrogenous Manure.	
		5. Fallow.	6. Clover or Beans.	3. Fallow.	4. Clover or Beans.	1. Fallow.	2. Clover or Beans.

Average of First Twenty Courses, 1848-1927.

	Roots (Swedes)	cwt.*	32.7	11.2	175.7	195.9	355.3	302.1
	Barley—							
	Dressed Grain	bush.	22.2	20.2	23.1	27.4	31.1	35.4
	Total Straw†	cwt.	13.6	13.4	13.7	15.7	18.8	21.8
	Beans—							
	Dressed Grain	bush.	—	13.1	—	18.2	—	22.3
	Total Straw	cwt.	—	9.2	—	13.2	—	15.3
	Clover Hay	cwt.	—	27.1	—	52.3	—	52.6
	Wheat—							
	Dressed Grain	bush.	24.0	22.3	28.1	30.6	28.9	30.4
	Total Straw †	cwt.	23.4	21.6	28.6	29.8	30.8	29.8

Present Course (21st), 1928 and 1929.

1928	Roots (Swedes)	cwt.	19.7	11.7	143.8	163.6	293.2	223.2
1929	Barley—							
	Dressed Grain	bush.	9.9	11.8	14.4	11.5	13.4	26.0
	Offal Grain	lb.	46.0	56.0	92.0	48.0	40.0	64.0
	Straw	lb.	516.0	750.0	765.0	1011.0	746.0	1619.0
	Total Straw†	cwt.	7.0	9.5	11.5	12.8	9.3	18.9
	Wt. of Dressed } Grain per bush. }	lb.	55.3	53.2	55.8	56.6	55.4	56.9
	Proportion of Total } Grain to 100 of }		75.6	64.5	69.6	48.8	74.7	72.9

\* Plots 1, 3 and 5 based upon 18 years. Plots 2, 4 and 6 based upon 17 years.

† Includes straw, cavings and chaff.

‡ Mineral Manure : 528 lb. Superphosphate (35%) ; 500 lb. Sulphate of Potash ; 100 lb. Sulphate of Soda ; 200 lb. Sulphate of Magnesia. All per acre.  
Nitrogenous Manure. 206 lb. Sulphate of Ammonia and 2,000 lb. Rape dust per acre.  
Manures applied once every four years, prior to sowing of swedes.

# MANGOLDS - BARNFIELD, 1929.

Roots each year since 1856. Mangolds each year since 1876.

## PRODUCE PER ACRE.

Strip	Strip Manures. (Amounts stated as per acre.)	1929.					50-Year Average, 1876-1928†								
		Cross Dressings.					Cross Dressings.								
		O	N	A	AC	C	O	N	A	AC	C				
	None.	Tons.	Nitrate of Soda (550 lb.)	Sulphate of Ammonia (412 lb.)	Sulphate of Ammonia and Rape Cake.	None.	Nitrate of Soda (550 lb.)	Sulphate of Ammonia (412 lb.)	Sulphate of Ammonia and Rape Cake.	Rape Cake (2,000 lb.)					
	Dung only (14 tons) .. .. .	10.79	18.14	13.53	12.46	14.82	26.16	21.70	23.58	23.53					
	Dung, Superphosphate (3½ cwt.), Sulphate of Potash (500 lb.) .. .. .	11.05	20.54	18.57	19.96	19.83	26.68	24.71	27.57	26.50					
	Complete Minerals: Superphosphate and Potash as 2, Salt (200 lb.), Sulphate of Magnesia (200 lb.) .. .. .	3.77	(a) 17.42*	14.03	20.67	15.91	(a) 18.11**	14.37	26.06	20.96					
	Superphosphate only (3½ cwt.) .. .. .	3.31	(b) 18.13	7.60	4.71	6.36	(b) 17.81	6.70	9.49	10.16					
	Superphosphate (3½ cwt.), Sulphate of Potash (500 lb.) .. .. .	3.64	14.98	13.17	16.60	4.47	14.63	13.50	22.55	18.14					
	Superphosphate (3½ cwt.), Sulphate of Magnesia (200 lb.) and Sodium Chloride (200 lb.) .. .. .	3.30	15.94	13.30	14.01	12.86	15.12	14.70	22.31	19.10					
	No Minerals .. .. .	2.97	10.85	6.32	5.53	4.46	16.04	5.32	8.52	8.89					
	Sodium Chloride (200 lb.), Nitrate of Soda (550 lb.), Sulphate of Potash (500 lb.) and Sulphate of Magnesia (200 lb.) .. .. .	16.31	—	—	—	—	—	—	—	—					
	Dung only (14 tons) .. .. .	1.99	3.51	2.61	2.19	3.17	4.65	4.93	5.25	4.54					
	Dung, Superphosphate (3½ cwt.), Sulphate of Potash (500 lb.) .. .. .	1.97	4.34	3.52	4.20	4.11	5.15	5.49	6.29	4.80					
	Complete Minerals: Superphosphate and Potash as 2, Salt (200 lb.), Sulphate of Magnesia (200 lb.) .. .. .	0.89	(a) 3.34*	2.54	3.94	2.70	(a) 4.05**	2.88	5.33	3.37					
	Superphosphate only (3½ cwt.) .. .. .	0.92	(b) 3.56	1.96	2.09	1.72	(b) 4.09	2.61	3.29	2.84					
	Superphosphate (3½ cwt.), Sulphate of Potash (500 lb.) .. .. .	0.98	2.76	2.00	3.11	2.12	3.04	2.81	5.20	2.87					
	Superphosphate (3½ cwt.), Sulphate of Magnesia (200 lb.) and Sodium Chloride (200 lb.) .. .. .	1.08	3.23	2.63	3.75	2.65	3.31	3.01	5.23	3.31					
	No Minerals .. .. .	0.83	3.05	1.93	1.83	1.61	3.19	2.52	3.30	2.84					
	Sodium Chloride (200 lb.), Nitrate of Soda (550 lb.), Sulphate of Potash (500 lb.) and Sulphate of Magnesia (200 lb.) .. .. .	2.79	—	—	—	—	—	—	—	—					

\* From 1904 onwards plot 4N has been divided, 4 (a) receiving Sulphate of Potash, Sulphate of Magnesia, Sodium Chloride and Nitrate of Soda, amounts as above, 4 (b) receiving Calcium Chloride (190 lb.), Potassium Nitrate (570 lb.) and Calcium Nitrate (100 lb.). Nitrogenous manures are applied as to one-third at time of sowing and two-thirds as top dressing at a later date, except with Rape Cake which all goes on with seed.  
 † Excluding 1885, when Nitrogenous Fertilisers were not applied, owing to poor crop, and 1908 and 1927 when the crop was swedes.  
 \*\* 23 years only, 1904-1928.



## HAY—THE PARK GRASS PLOTS.

Plot.	Manuring (amounts stated are per acre).	1929.						Plot.	
		Yield of Hay per acre.			Dry Matter per acre.				
		1st Crop.	2nd† Crop.	Total.	1st Crop.	2nd Crop.	Total.		
		cwt.	cwt.	cwt.	lb.	lb.	lb.		
1	Single dressing (206 lb.), Sulphate of Ammonia (=43 lb. N.); (with Dung also 8 years 1856-63)	not limed	2.8	0.5	3.3	243	42	285	1
		limed ..	12.1	0.6	12.7	1081	53	1134	
2	Unmanured (after Dung 8 years, 1856-63)	not limed	7.1	0.3	7.4	644	31	675	2
		limed ..	8.2	0.4	8.6	703	37	740	
3	Unmanured .. .. .	not limed	6.3	0.3	6.6	535	27	562	3
		limed ..	6.9	0.3	7.2	591	29	620	
4-1	Superphosphate of Lime (3½ cwt.) .. ..	not limed	10.2	0.4	10.6	846	33	879	4-1
		limed ..	7.4	0.4	7.8	652	32	684	
4-2	Superphosphate of Lime (3½ cwt.) and double dressing (412 lb.) Sulphate of Ammonia (=86 lb. N.) .. .. .	not limed	1.0	0.6	1.6	86	52	138	4-2
		limed ..	24.1	1.5	25.6	2363	133	2496	
5-1	(N. half) Unmanured following double dressing Ammonia Salts (=86 lb. N.) 1856-97 .. ..	not limed	2.3	0.8	3.1	207	72	279	5-1
5-2	(S. half) Superphosphate (3½ cwt.); Sulphate of Potash (500 lb.), following double dressing Ammonia Salts (=86 lb. N.) 1856-97 .. ..	not limed	8.5	0.8	9.3	783	75	858	5-2
6	Complete Mineral Manure as Plot 7; following double dressing Ammonia Salts (=86 lb. N.) 1856-68 .. .. .	not limed	15.3	1.8	17.1	1345	158	1503	6
7	Complete Mineral Manure; Superphosphate (3½ cwt.); Sulphate of Potash (500 lb.); Sulphate of Soda (100 lb.); Sulphate of Magnesia (100 lb.) .. .. .	not limed	15.1	1.7	16.8	1351	157	1508	7
		limed ..	30.9	0.8	31.7	2910	73	2983	
8	Mineral Manure without Potash .. .. .	not limed	8.3	0.9	9.2	704	79	783	8
		limed ..	7.5	0.3	7.8	632	24	656	
9	Complete Mineral Manure and double dressing (412 lb.) Sulphate of Ammonia (=86 lb. N.) .. ..	not limed	0.9	0.1	1.0	77	11	88	9
		limed ..	45.8	0.8	46.6	4117	71	4188	
10	Mineral Manure (without Potash) and double dressing Ammonia Salts (=86 lb. N.) .. .. .	not limed	2.4	0.1	2.5	205	7	212	10
		limed ..	32.1	1.4	33.5	3158	127	3285	
11-1	Complete Mineral Manure and treble dressing (618 lb.); Sulphate of Ammonia (129 lb. N.) .. ..	not limed	1.1	1.1	2.2	90	99	189	11-1
		limed ..	48.3	1.6	49.9	4473	142	4615	
11-2	As Plot 11-1 and Silicate of Soda .. .. .	not limed	7.8	5.6	13.4	641	499	1140	11-2
		limed ..	47.6	2.7	50.3	4374	244	4618	
12	Unmanured .. .. .	not limed	7.7	0.7	8.4	682	62	744	12
13	Dung (14 tons) in 1905, and every fourth year since (omitted 1917), Fish Guano (6 cwt.) in 1907 and every fourth year since .. .. .	not limed	24.2	3.2	27.4	2107	289	2396	13
		limed ..	22.4	1.4	23.8	1945	122	2067	
14	Complete Mineral Manure and double dressing (550 lb.) Nitrate of Soda (=86 lb. N.) .. ..	not limed	39.8	2.4	42.2	3519	219	3738	14
		limed (sun)	40.3	1.4	41.7	3444	124	3568	
		limd (shade)	34.4	0.7	35.1	3051	61	3112	
		not limed	14.5	1.4	15.9	1222	125	1347	15
15	Complete Mineral Manure as Plot 7, following double dressing Nitrate of Soda (=86 lb. N.) 1858-1875 .. .. .	limed ..	22.4	0.5	22.9	2081	45	2126	
16	Complete Mineral Manure and single dressing (275 lb.) Nitrate of Soda (=43 lb. N.) .. ..	not limed	23.1	1.8	24.9	2540	158	2698	16
		limed ..	23.6	1.4	25.0	2343	123	2466	
17	Single dressing (275 lb.) Nitrate of Soda (=43 lb. N.) .. .. .	not limed	12.9	0.9	13.8	1071	78	1149	17
		limed ..	16.7	0.7	17.4	1471	65	1536	
18	Mineral Manure (without Superphosphate), and double dressing Sulphate of Ammonia (=86 lb. N.), 1905 and since; following Minerals and Ammonia Salts supplying the constituents of 1 ton of Hay, 1865-1904 .. .. .	not limed	2.7	0.3	3.0	236	27	263	18
		limed	36.9	1.1	38.0	3295	102	3397	
		(6788 lb.)							
		limed	28.8	1.0	29.8	2542	92	2634	
19	Farmyard Dung (14 tons) in 1905 and every fourth year since (omitted in 1917), following Nitrate of Soda (=43 lb. N.), and Minerals, 1872-1904 .. .. .	not limed	16.5	1.3	17.8	1554	118	1672	19
		limed	15.2	0.7	15.9	1422	64	1486	
		(3150 lb.)							
		limed	16.5	0.9	17.4	1541	84	1625	
20	Farmyard Dung (14 tons) in 1905 and every fourth year since (omitted in 1917); each intervening year Plot 20 receives Sulphate of Potash (100 lb.); Superphosphate (200 lb.) and 1½ cwt. Nitrate of Soda (=26 lb. N.); following Nitrate of Potash and Superphosphate, 1872-1904 .. .. .	not limed	28.1	1.3	29.4	2676	117	2793	20
		limed	25.1	1.1	26.2	2287	94	2381	
		(2772 lb.)							
		limed ..	25.1	1.2	26.3	2328	112	2440	
		(570 lb.)							

Ground Lime was applied to the southern portion (Limed) of the plots at the rate of 2000 lb. to the acre in the Winters of 1903-4, 1907-8, 1915-16, 1923-24, 1927-28, and at the rate of 2500 lb. to the acre in the Winter of 1920-21, except where otherwise stated.

Up to 1914 the Limed and Unlimed plot results were not separately given in the Annual Report, but the mean of the two was given. From 1915 onwards the separate figures are given.

† The second crop was carted green; the figures given are estimated hay yields, calculated from the dry matter.

WHEAT--BROADBALK FIELD.

Plot.	Manurial Treatment. (amounts stated are per acre).	1929 (Upper or Western Part) second year after fallow.						74-year Average 1852-1925 (Prior to fallow).		
		Dressed Grain		Offal Grain per acre.	Straw per acre.	Total † Straw per acre.	Proportion of Total Grain to 100 of Total Straw.	Dressed Grain per acre.	Total Straw per acre.	
		Yield per acre.	Weight per bushel.							Yield per acre.
2A	Farmyard Manure (14 tons) ..	23.3	61.3	12.7	120	2557	28.9	47.7	26.8**	32.1**
2B	Farmyard Manure (14 tons) ..	30.0	63.0	16.9	95	3579	40.1	44.2	33.5	34.2
3	Unmanured since 1839 ..	9.1	60.5	4.9	49	855	11.1	48.3	11.7	9.8
5	Complete Mineral Manure §§ ..	9.1	60.5	4.9	40	762	9.4	56.4	13.5	11.5
6	As 5, and 206 lb. Sulphate of Ammonia ..	17.7	61.8	9.8	55	1730	19.0	54.4	21.7	20.3
7	As 5, and 412 lb. Sulphate of Ammonia ..	20.9	61.3	11.4	89	3585	39.1	33.6	30.4	32.1
8	As 5, and 618 lb. Sulphate of Ammonia ..	15.9	59.7	8.5	128	5288	57.6	17.3	34.5	39.8
9	As 5, and 275 lb. Nitrate of Soda ..	21.6	61.4	11.9	96	2905	31.5	40.4	18.8††	24.6††
10	412 lb. Sulphate of Ammonia ..	24.7	61.4	13.6	117	3048	33.6	43.6	18.7	17.8
11	As 10, and Superphosphate (3½ cwt.) ..	19.0	60.8	10.3	109	2600	29.2	39.3	21.3	21.4
12	As 10, and Super. (3½ cwt.) and Sulph. Soda (366 lb.) ..	22.9	61.1	12.5	124	3147	34.4	39.8	27.0	26.8
13	As 10, and Super. (3½ cwt.) and Sulph. Potash (200 lb.) ..	25.6	61.6	14.1	103	3348	35.7	42.3	29.2	30.6
14	As 10, and Super. (3½ cwt.) and Sulph. Magnesia (280 lb.) ..	23.4	61.1	12.8	101	2949	32.2	42.9	26.7	26.8
15	As 5, and 412 lb. Sulphate of Ammonia all applied in Autumn ..	28.8	61.1	15.7	108	3262	36.6	45.5	27.8	28.2
16	As 5, and 550 lb. Nitrate of Soda ..	26.3	61.4	14.5	137	4079	44.8	36.3	29.9††	35.2††
17	Minerals alone as 5 or 412 lb. Sulphate of Ammonia alone (M ..	6.8	60.4	3.7	54	716	9.0	45.9	A27.8	27.7
18	in alternate years ..	A18.2	61.4	10.0	88	2236	24.5	44.5	M14.1	12.5
19	Rape Cake (1889 lb.) ..	26.1	61.6	14.3	97	2801	31.2	48.8	20.8†	22.0†
20	As 7, without Super. ..	29.9	61.5	16.4	84	3407	36.2	47.4	16.5§	18.6§

† Includes straw, cavings and chaff. 1929, bottom portion fallowed.

\*\* 26 years only, 1900-1925. †† 41 years only, 1885-1925. † 33 years only, 1893-1925. § 18 years only, 1906-1925 (no crop in 1912 and 1914).

§§ Complete Mineral Manure : 3½ cwt. Super, 200 lb. Sulph. Potash, 100 lb. Sulph. Soda, 100 lb. Sulph. Magnesia.

Sulphate of Ammonia is applied as to one-third in Autumn and two-thirds in Spring, except for plot 15. Nitrate of Soda is all given in Spring, there being two applications at an interval of a month on Plot 16.

In 1926 and 1927 the crop was confined to the lower (eastern) part of the field, the upper part being completely fallowed for 2 years. This was the first complete fallow on this area since the experiment began in 1843. In October, 1927, the upper or western part was sown with wheat, and again in 1928, the yields for 1929 being given above.

## PERMANENT BARLEY PLOTS. Hoos Field, 1929.

Plot.	Manuring. (Amounts stated are per acre.)	Grain, per acre.		76 Years' Average 1852-1928 Dressed Grain per acre bush.¶	Straw, per acre.		76 Years' Average 1852-1928 Total Straw per acre cwt.†
		Plumage Archer Cwt.	Spratt Archer Cwt.		Plumage Archer Cwt.	Spratt Archer Cwt.	
1O	Unmanured .. .. .	2.4	2.5	13.4	1.9	2.0	7.8
2O	Superphosphate only (3½cwt.) ..	5.0	4.8	19.0	3.8	3.7	9.8
3O	Alkali Salts only (200lb. Sulphate of Potash; 100lb. Sulphate of Soda; 100 lb. Sulphate of Magnesia) .. .. .	3.9	3.8	14.3	3.2	3.4	8.7
4O	Complete Minerals; as 3O with Superphosphate (3½ cwt.)	6.2	7.3	19.0	5.4	5.9	11.2
5O	Potash (200 lb.) and Superphosphate (3½ cwt.) .. .. .	3.0	2.9	15.5	3.7	4.3	9.4
1A	Ammonium Salts only (206 lb. Sulphate of Ammonia) .. .. .	1.8	1.9	23.7	1.5	1.4	13.7
2A	Superphosphate and Amm. Salts ..	8.7	9.0	35.8	7.4	7.4	20.4
3A	Alkali Salts and Amm. Salts ..	3.6	2.3	25.8	3.9	2.4	16.0
4A	Complete Minerals and Amm. Salts	10.0	9.4	39.3	8.7	7.9	23.6
5A	Potash, Super. and Amm. Salts ..	4.4	4.4	33.8	5.5	4.5	21.7
1AA	Nitrate of Soda only (275 lb.) ..	3.5	2.7	24.3*	3.3	2.6	15.4*
2AA	Superphosphate and Nitrate of Soda	10.9	11.2	38.8*	8.0	10.4	23.1*
3AA	Alkali Salts and Nitrate of Soda ..	3.7	4.3	24.5*	3.7	4.3	16.6*
4AA	Complete Minerals and Nitrate of Soda .. .. .	<b>10.1</b>	9.2	37.7*	<b>9.1</b>	8.8	23.6*
1AAS	As Plot 1AA and Silicate of Soda (400 lb.) .. .. .	2.6	2.4	30.2*	2.4	2.3	18.2*
2AAS	As Plot 2AA and Silicate of Soda (400 lb.) .. .. .	11.4	11.3	39.7*	8.0	8.0	23.9*
3AAS	As Plot 3AA and Silicate of Soda (400 lb.) .. .. .	4.0	5.5	31.2*	4.1	4.9	19.9*
4AAS	As Plot 4AA and Silicate of Soda (400 lb.) .. .. .	10.0	11.1	39.9*	10.3	9.9	25.4*
1C	Rape Cake only (1000 lb.) .. .. .	3.5	4.5	35.5	2.8	4.5	20.6
2C	Superphosphate and Rape Cake ..	8.1	9.8	38.1	7.5	8.7	22.0
3C	Alkali Salts and Rape Cake ..	5.4	6.2	33.7	5.0	5.3	20.4
4C	Complete Minerals and Rape Cake	8.1	11.0	37.5	9.3	9.8	22.6
7-1	Unmanured (after dung (14 tons) for 20 years 1852-71) .. .. .	6.0	5.9	22.5‡	5.5	5.1	13.5‡
7-2	Farmyard Manure (14 tons) ..	14.8	15.1	44.6	14.3	13.4	28.1
6-1	Unmanured since 1852 .. .. .	2.6	3.7	14.7	2.8	3.2	8.6
6-2	Ashes from Laboratory furnace ..	2.7	3.3	15.7	2.3	3.1	9.3
1N	Nitrate of Soda only (275 lb.) ..	1.3	2.1	28.7§	2.5	3.1	17.8§
2N	Nitrate of Soda only (275 lb.) ..	3.8	4.2	31.7§§	4.0	4.2	20.0§§

1 cwt. = 2.15 bushels.

¶ 1912, all plots were fallowed. †Total straw includes straw, cavings and chaff.

\* 60 years, 1868-1928. ‡ 56 years, 1872-1928. § 75 years, 1853-1928. §§ 69 years, 1859-1928.

The field this year was sown across by the half-drill strip method in wide spaced drills to facilitate cleaning operations. Total sheaf weight only was taken and the Grain/Straw ratio determined in samples; Grain and Straw per acre being determined from this ratio. The sample for Plot 4AA (Plumage Archer) was lost, and the figures given in heavy type are derived from the (logarithmic) average Grain/Straw ratio for the seven remaining Plots in Series AA and AAS.