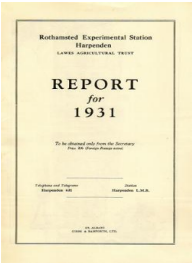
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ROTHAMSTED RESEARCH

Report for 1931

Full Table of Content



Rothamsted Experimental Plots, 1931

Rothamsted Research

Rothamsted Research (1932) *Rothamsted Experimental Plots, 1931 ;* Report For 1931, pp 108 - 198 **- DOI: https://doi.org/10.23637/ERADOC-1-65**

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THE USE OF THE SUMMARY TABLES

The summaries of the significant results from the replicated experiments, whether these are stated as produce per acre or as a percentage of the average yield, are accompanied by estimates of the standard errors to which these results are liable. The agricultural precautions which have to be taken in order that these shall be certainly valid were explained in the Report for 1925-26. An explanation of their purpose is desirable here in order that a full use of the summaries may be made by those who do not wish to make for themselves a detailed examination of the yields recorded for individual plots.

An experimental yield will differ from its true value either in excess or deficit by an amount exceeding its standard error almost as frequently as once in 3 trials ; it will, however, be wrong by more than twice its standard error only about once in 22 trials, and by more than three or four times its standard error once in 370 or 15,780 trials respectively. The odds against an error of any size having occurred thus increase very rapidly in a small range of multiples of the standard error. Whereas experimental differences of less than twice their standard error might always be ascribed to chance, and are, therefore, for safety, ignored as " insignificant," differences only slightly greater than these, in contrasts which the experiment was designed to examine cannot reasonably be disregarded, but must be ascribed to genuine manurial or cultural effects.

The rejection of the insignificant differences is thus a necessary preliminary, but only a preliminary, to the interpretation of the experimental results. All significant results are noted, and so far as has been practicable, exhibited in the summaries of results. In the more successful and extensive experiments the standard error has been reduced to a very low figure, so that quite small differences in yields can be detected, whereas with a larger standard error, all but big and obvious differences in yield must be ignored. The change in precision from standard errors of 5 per cent. to standard errors of 2 per cent. thus represents a very large extension in the range of agricultural effects which can be examined experimentally.

Once an effect is shown to be definitely significant it makes little difference whether the odds against its being due to chance are 100 to 1 or 1,000,000 to 1. Chance is effectively excluded in both cases, and the interest in the result is now concentrated on the actual gain in crop, either in yield per acre or in yield per cent., which the experiment has demonstrated. The relation of this gain to any additional item of expense incurred, such as the cost of a manurial application, then determines the balance of advantage in practical procedure. Read in this way the summary tables give the direct results of critical experimentation.

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DATES OF SOWING AND HARVESTING, AND YIELD PER ACRE, ROTHAMSTED, 1931

Field.	Crop.	Variety.	Principal Cultivations and Dates.	Manuring cwt. per acre.	Sowing Dates.	Cutting Dates.	Carting Dates.	Yield per acre.
I. Arable and Replicated Experiments—								
Pastures (1)	Mangolds	Yellow Globe	Jan. 26 plough, Feb. 26 horse harrow. April 15 roll. May 13, 29 and June 25 grubbed. June 2-3 side hoe. June 19-July 8 single. Hoed throughout summer.	2 S/Amm. 1 S/Potash ¾ Super.	April 14	—	Oct. 2 and 3	30 tons
(2)	Potatoes (Expt.)	Ally	Jan. 26, Mar. 4-21 plough. Mar. 28 cultivate with tractor, then roll and harrow. Mar. 30 cultivate 2nd time.	see p. 154	April 13	—	Sept. 30	see p. 154-5
(3)	Oats	Marvellous	Jan. 26 plough, Feb. 26 horse harrow. Feb. 27 harrow in.	—	Feb. 27	Aug. 18	Sept. 9	14 cwt.
(4)	Beans and Barley		Jan. 26 plough. Feb. 26 horse harrow. Feb. 27 harrow in.	—	Feb. 27	Aug. 21	Sept. 10	23 cwt.
(5)	Kale		June 27 plough in spring oats near gate. Work down and harrow in with tractor. Folded off in Sept.	1 S/Amm.	June 27	—	—	—
Gt. Harpenden (1)	Winter Oats	Grey Winter	Sept. 23, 1930, plough. Oct. 7 tractor harrow and harrow in oats. Mar. 23-25 harrow. April 24 sow N/Soda.	3 Super. 3 Potash Salt ¾ N/Soda late spring.	Oct. 6-7	Aug. 7	Aug. 24 and 25	18 cwt.
(2)	Wheat Varieties	Wilhelmina Swedish Iron Victor	Sept. 23, 1930, plough. Oct. 7 tractor harrow. Oct. 14-15 harrow in. April 24 sow N/Soda.	3 Super. 3 Potash Salt ¾ N/Soda late spring.	Oct. 14-15	Aug. 21	Aug. 24 and 25	17 cwt. (W) 19 ,, (S) 18 ,, (V)
(3)	Spring Oats (Expt.)	Marvellous, Victory and Golden Rain	Dec. 29, 1930-Jan. 12 horse plough. Feb. 25 horse harrow and then harrow in. Mar. 19 sow N/Soda.	3 Super. 3 Potash Salt ¾ N/Soda early spring.	Feb. 25	Aug. 17	Sept. 7	see p. 143-4

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DATES OF SOWING AND HARVESTING, AND YIELD PER ACRE, ROTHAMSTED, 1931 (*Cont.*)

Field.	Crop.	Variety.	Principal Cultivations and Dates.	Manuring cwt. per acre.	Sowing Dates.	Cutting Dates.	Carting Dates.	Yield per acre.
Gt. Harpenden (*cont.*) (4)	Rye	—	Sept. 22, 1930, plough. Oct. 7 tractor harrow. Oct. 14-15 harrow in. April 24 sow N/Soda. All undersown trefoil (5 lb.) and Western Wolths Ryegrass (20 lb.) on April 15. April 17-24 horse harrow.	3 Super. 3 Potash Salt ¾ N/Soda late spring.	Oct. 14-15	Aug. 7	Aug. 24 and 25	18 cwt.
(5)	Sugar Beet (Expt.)	Kuhn	Mar. 17 plough in dung with horses, harrow after with tooth harrows. May 1 harrow and roll. Hand dig the plots marked for this treatment. May 8 cultivate with Duotrac implements, harrow and roll. June 15-July 9 hand hoe.	see p. 157	May 8 and 9	—	Nov. 3	see p. 157-9
Little Hoos (1)	Wheat (Cultivation Expt.)	Million	Oct. 3-10, 1930, cultivate. April 1 harrow and roll.	see p. 148	Oct. 10	Aug. 24	Sept. 9-11	see p. 148-9
(2)	Wheat (Top Dressing Expt.)	Million	Sept. 18, 1930, tractor plough. Oct. 10, tooth-harrow twice. Mar. 26 roll.	see p. 145	Oct. 10	Aug. 19-22	Sept. 7-9	see p. 145-6
(3)	Forage (Expt.)	Oats, Wheat, Vetches, Peas and Beans	Sept. 18-23, 1930, horse plough. Oct. 10-11 horse drag and disc harrow. Mar. 26 tooth-harrow and roll.	see p. 150	Oct. 9-11	July 9-14	Sept. 11-17	see p. 151-3
Pennell's Piece	Spring Oats	Marvellous	Jan. 13 plough. Feb. 26 horse harrow before and after drilling.	—	Feb. 26	Aug. 20	Sept. 10	24 cwt.
Great Knott	Beans	Winter	Sept. 10-22, 1930, plough. Oct. 1 harrow in. Horse and hand hoe Feb.-June.	3 Potash Salt 3 Super.	Oct. 1	Aug. 10-12	Sept. 8-12	26 cwt.
Long Hoos (I)	Kale (after Rye for sheep)	Marrow-stem and Thousand-headed	Sept. 1930 cart dung and plough in. Sept. 26 sow rye. Eaten by sheep April-May. May 21-June 12 several times tractor plough and cultivate. Aug. 4 horse hoe.	15 tons dung for rye. 2 N/Soda.	June 13	Sheep folded and February	January	16-18 tons
(II and III)	Linseed (after Rye for sheep)	Argentine ?	April 30-May 6 plough and cultivate. May 7 roll and harrow.	15 tons dung for rye. 1 S/Amm.	May 7	Sept. 16-19	Oct. 7	10½ cwt.

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DATES OF SOWING AND HARVESTING, AND YIELD PER ACRE, ROTHAMSTED, 1931 (*Cont.*)

Field.	Crop.	Variety.	Principal Cultivations and Dates.	Manuring, cwt. per Acre.	Sowing Dates.	Cutting Dates.	Carting Dates.	Yield per acre.
Long Hoos (V) (*cont.*)	Temporary Ley (Expt.)	—	April 11 roll. June 16-18 plough with horses, plots that had one crop only.	see p. 141	April 11	July 2, 1st crop Aug. 27, 2nd crop	July 3, 1st crop, for silage Sept. 21, 2nd crop, for hay	see p. 141
(VI)	Maize after Rye	Giant Horse Tooth	May 20-21 tractor plough. May 30 harrow, then roll. Harrow in. June 1 roll. July 22-Sept. 1 hand and horse hoe.	2 S/Amm.	May 30	Sept. for cows	—	—
(VII)	Rape Kale (after Rye)	—	July 25 harrow. July 27-30 carting and spreading dung. Aug. 1 harrow and roll. Sept. 14-15 horse hoe.	20 tons dung.	Aug. 1	—	—	—
Fosters	Barley (Expt. undersown for ley)	Plumage Archer	Mar. 19-21 horse plough. Mar. 23 harrow twice. Mar. 24 harrow in Mar. 27 horse roll.	see p. 142	Mar. 23 barley April 23 the rest	Aug. 27	Sept. 14	see p. 142
	Forage (Expt.)	—	July 8-11 plough. July 16 tractor cultivate. July 20-21 harrow. July 25 harrow in all seeds.	3 Super. 2 Potash Salt 3 S/Amm.	July 22-24	Nov. 17 and 18	Nov. 18 and 19	Expt. still in progress
	Seeds Hay	16lb. Ital. Rye Grass 12lb. Broad Red Clover	Dec. 3-4 sow manure. Mar. 4, 1st application of N/Soda. Apr. 25 2nd application of N/Soda. Apr. 7 horse roll.	2½ Super. 3 Potash Salt (30%). 2 N/Soda.	April 11, 1930	(1) June 11-12 for silage June 16 for Hay	June 12-13 June 22-23	40 cwt. (10 acr.)
						(2) Aug. 26	Sept. 21	20 cwt. (4 acr.)
II. Grass Land— Little Knott (1)	Grazing	—	—	—	—	—	—	—
(2)	Grazing	—	—	—	—	—	—	—
(3)	Grass for silage	—	—	—	—	June 23	June 24	—
Foster's Corner	Grazing	—	—	3 Potash Salt (winter)	—	—	—	—

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DATES OF SOWING AND HARVESTING, AND YIELD PER ACRE, ROTHAMSTED, 1931 (*Cont.*)

Field.	Crop.	Variety.	Principal Cultivations and Dates.	Manuring cwt. per acre.	Sowing Dates.	Cutting Dates.	Carting Dates.	Yield per acre.
Great Knott (1)	Grazing then hay	—	June 27 turn hay.	—	—	June 20-22	June 29	15 cwt.
(2)	Grazing	—	June 20-22 topped with tractor mower.	—	—	—	—	—
Great Field	Grazing	—	Mar. 14 horse roll. June 9 topped section 2 with horse mower. July 13 topped section 1 with tractor mower.	3½ Potash Salt (winter)	—	—	—	—
New Zealand	Grazing	—	June 21 topped with tractor mower.	—	—	—	—	—
Stackyard	Grazing	—	June 19 topped with tractor mower.	—	—	—	—	—
West Barnfield (1)	Grazing	—	July 21 topped with tractor mower.	3 Potash Salt (winter)	—	—	—	—
(2)	Grazing	—	July 21 topped with tractor mower.	3 Potash Salt (winter)	—	—	—	—
Sawyers (1)	Grazing, then hay	—	Feb. 12-13 sow N/Soda. Jun. 19 tractor topped.	1 N/Soda.	—	June 29	July 6-8	20 cwt.
(2)	Grazing, then hay	—	Dec. 9-15, 1930, Super. and Potash Salt applied. June 30-31 topped with tractor mower.	3 Super. 3 Potash Salt	—	July 1	July 9-11	20 cwt.
(3)	Hay, after early grazing	—	Dec. 9-15 Super. and Potash Salt applied. Feb. 12 N/Soda applied. May 10 closed for hay.	2¾ Super. 2 Potash Salt 1 N/Soda (spring)	—	June 26	July 3	30 cwt.
Gt. Harpenden	Grazing	—	Mid July topped with tractor mower. Then put up for crop of wild white clover seed, but weather prevented, so made into ordinary hay.	—	—	Sept. 16-21 (cut with tractor)	—	20 cwt.
III. Classical and Rotation Experiments— Broadbalk	Wheat	Red Standard	Aug. 30 and Sept. 1, 1930, tractor cultivate. Oct. 2-7 tractor plough. Oct. 15 tractor drawing disc harrows followed by drag harrow. Oct. 16 harrow in seed.	see p. 126	Oct. 16	Aug. 17 and 18	Aug. 27-29	see p. 125-6

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DATES OF SOWING AND HARVESTING, AND YIELD PER ACRE, ROTHAMSTED, 1931 (*Cont.*)

Field.	Crop.	Variety.	Principal Cultivations and Dates.	Manuring, cwt. per acre.	Sowing Dates.	Cutting Dates.	Carting Dates.	Yield per acre.
Hoos	Barley	Plumage Archer Spratt Archer	Sept. 15, 1930, cultivate. Mar. 7 plough in dung. Mar. 16 harrow all plots except 7^1 and 7^2. Mar. 18 harrow in seed. Hand and horse hoe on various dates, May 11-July 23. Rows again 18 ins. apart.	see p. 128	Mar. 17	Aug. 28 and 29	Sept. 24-25	see p. 128
Barnfield	Mangolds and Swedes	(M) Prize Winner Yellow Globe (S) Purple Top	Nov. 17-19, 1930, steam plough. Mar. 26 and 27 cultivate across. April 15 cultivate for seed bed. May 21 preparing land for resowing. July to Aug. horse and hand hoe.	see p. 120	April 15-17 Mangolds (Resown with Mangolds and Swedes May 26)	—	Oct. 19-28	see p. 120-1
Agdell	Wheat	Red Standard	Oct. 14 and 15, 1930, tractor plough. Oct. 31 disc harrow.	see p. 118	Oct. 31 and Nov. 1	Aug. 24	Aug. 26	see p. 118
Park	Hay	—	Mar. 28 drag harrow. Mar. 30 horse roll.	see p. 122	—	June 25-27 (1st crop) Nov. 10-13 (2nd crop)	June 30 and July 1 Nov. 13	see p. 122
Gt. Hoos 4 Course Rotation	Wheat	Yeoman	Aug. 5 and Oct. 29, 1930 plough Oct. 30 harrow before and after sowing seed. April 1 roll.	see p. 132	Oct. 30	Aug. 27	Sept. 7	see p. 133
	Swedes	Garton's Magnificent	Dec. 8-9, 1930, plough. May 8-9 plough and harrow after. May 20 harrow and roll. June 26 and Sept. 15 horse hoe.	see p. 132	May 20	—	Nov. 6-17	see p. 133
	Seeds	Italian Rye Grass, Dutch White Clover, Alsike Clover	April 1, roll.	see p. 132	April 22	June 24	June 24	see p. 133
	Barley	Plumage Archer	Dec. 8-10, 1930, plough. Mar. 6 harrow before and after sowing. Mar. 25 roll.	see p. 132	Mar. 6	Aug. 27	Sept. 14	see p. 134

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DATES OF SOWING AND HARVESTING, AND YIELD PER ACRE, ROTHAMSTED, 1931 (*Cont.*)

Field	Crop.	Variety.	Principal Cultivations and Dates.	Manuring, cwt. per acre.	Sowing Dates.	Cutting Dates.	Carting Dates.	Yield per acre.
Long Hoos 6 Course Rotation	Wheat	Yeoman II	Aug. 20-26, 1930, cultivate.	see p. 131	Oct. 3	Aug. 21	Aug. 27	see p. 135
	Sugar Beet	Kuhn	Aug. 20-26, 1930, cultivate. Feb. 5-May 6 plough. May 7 harrow and roll. June 26-July 27 hand and horse hoe.	see p. 131	May 9	—	Nov. 3-6	see p. 135
	Barley	Plumage Archer	Aug. 20-26, 1930 cultivate. Feb. 5-6 plough. Mar. 6 harrow before and after sowing. Mar. 26 roll	see p. 131	Mar. 6	Aug. 29	Sept. 7	see p. 135
	Clover	Broad Red	Aug. 20-26, 1930, cultivate. April 1 roll.	see p. 131	April 22	June 10	June 10	see p. 136
	Potatoes	Ally	Aug. 20-26, 1930, cultivate. Feb. 4 plough. April 11 harrow	see p. 131	April 14	—	Oct. 1	see p. 136
	Forage	Rye, Beans, Vetches, followed by Mustard	Aug. 20-26, 1930, cultivate.	see p. 131	Oct. 3	June 10	June 10	see p. 136

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CROP YIELDS ON THE EXPERIMENTAL PLOTS

Notes.—In each case the year refers to the harvest, *e.g.*, Wheat 1931 means wheat harvested in 1931. 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 in the replicated experiments 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. 1.366 Maunds.
1 ton (20 cwt. or 2,240 lb.) =	1016 Kilogrammes.	
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.	
1 kg. per Hectare .. =	0.892 lb. per acre	

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

CONVERSION TABLE.—CWT. TO BUSHELS.

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, 1919–28. cwt.	Country.	Mean yield per acre, 1919–28. cwt.
Great Britain	17.5	Denmark	22.8
England	17.4	Argentine	6.6
Hertfordshire	16.4	Australia	6.4
France	10.9	Canada	8.9
Germany	14.5	United States	7.6
Belgium	20.3	U.R.S.S. (Europe and Asia)*	5.8

Note.—Figures for Great Britain, England and Hertfordshire are taken from the Ministry of Agriculture's "Agricultural Statistics," Vols. 54-63. Other figures from "International Year Book of Agricultural Statistics," 1919–29.
*1924–28.

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METEOROLOGICAL RECORDS, 1931

	Rain.		Drainage through soil.			Bright Sunshine.	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.
1931.	Inches.	No.	Inches.	Inches.	Inches.	Hours.	°F.	°F.	°F.	°F.	°F.
Jan. ..	1.704	21	1.231	1.323	1.321	64.8	41.6	32.8	36.9	64.9	28.7
Feb. ..	1.870	20	1.180	1.329	1.301	65.4	42.7	32.7	37.1	81.4	29.8
Mar. ..	0.091	3	0.073	0.166	0.160	153.6	46.2	31.8	38.0	97.1	27.9
April ..	3.460	20	1.538	1.683	1.669	115.7	51.4	39.2	44.3	104.5	36.7
May ..	2.532	15	0.878	0.971	0.993	172.6	59.2	44.3	51.3	118.4	39.6
June ..	1.520	9	0.007	0.054	0.041	198.0	65.3	50.8	58.9	133.6	46.9
July ..	3.942	19	1.440	1.666	1.703	157.8	65.9	52.5	60.6	132.7	48.7
Aug. ..	3.455	17	1.609	1.681	1.662	155.6	64.1	51.3	58.7	127.8	47.8
Sept. ..	2.128	15	0.829	0.904	0.862	120.6	58.2	46.4	54.4	113.2	42.0
Oct. ..	0.664	9	0.000	0.010	0.003	118.4	54.4	40.9	49.2	101.1	35.7
Nov. ..	3.202	21	2.425	2.429	2.374	68.9	50.0	39.0	44.7	78.6	33.8
Dec. ..	1.109	12	0.643	0.696	0.662	40.5	44.6	36.2	41.1	62.9	32.3
Total or Mean	25.677	181	11.853	12.912	12.751	1431.9	53.6	41.5	47.9	101.3	37.5

RAIN AND DRAINAGE.

MONTHLY MEAN FOR 61 HARVEST YEARS, 1870-1—1930-31.

	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.
	Ins.	Ins.	Ins.	Ins.	%	%	%	Ins.	Ins.	Ins.
Sept. ..	2.381	0.819	0.794	0.733	34.4	33.3	30.8	1.562	1.587	1.648
Oct. ..	3.139	1.791	1.760	1.629	57.1	56.1	51.9	1.348	1.379	1.510
Nov. ..	2.881	2.204	2.260	2.131	76.5	78.4	74.0	0.677	0.621	0.750
Dec. ..	2.871	2.451	2.553	2.437	85.4	88.9	84.9	0.420	0.318	0.434
Jan. ..	2.410	1.975	2.169	2.070	81.9	90.0	85.9	0.435	0.241	0.340
Feb. ..	2.029	1.511	1.625	1.552	74.5	80.1	76.5	0.518	0.404	0.477
March ..	1.966	1.048	1.176	1.112	53.3	59.8	56.6	0.918	0.790	0.854
April ..	2.051	0.673	0.754	0.718	32.8	36.8	35.0	1.378	1.297	1.333
May ..	2.068	0.483	0.551	0.518	23.3	26.6	25.0	1.585	1.517	1.550
June ..	2.213	0.531	0.561	0.540	24.0	25.3	24.4	1.682	1.652	1.673
July ..	2.739	0 728	0.758	0.709	26.6	27.7	25.9	2.011	1.981	2.030
Aug. ..	2.663	0.717	0.731	0.687	26.9	27.5	25.8	1.946	1.932	1.976
Year ..	29.411	14.931	15.692	14.836	50.8	53.3	50.4	14.480	13.719	14.575

Area of each gauge 1/1000th acre.

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CHEMICAL ANALYSES OF MANURES USED IN REPLICATED EXPERIMENTS, 1931

Manures.	% N.	Manures.	Total.	% P_2O_5 Soluble in water.	% P_2O_5 Soluble in Cit. Acid
Sulphate of Amm. (1)	20.8	Superphosphate (3) ..	16.7	15.9	—
Sulphate of Amm. (2)	21.0	Superphosphate (4) ..	17.0	15.4	—
Muriate of Amm. ..	26.0	Superphosphate (5) ..	16.1	—	—
Nitrate of Soda ..	15.7	Mineral Phosphate (90% through 120 mesh) ..	25.9	—	—
Cyanamide ..	20.0	Basic Slag—High Sol.	14.9	—	14.4
		Basic Slag—Low Sol. ..	15.1	—	3.5

Manures.	% K_2O	% Cl	Manures.	% N.	% P_2O_5	% K_2O
Sulphate of Potash	49.3	—	Chicken Manure ..	1.37	1.61	0.72
Muriate of Potash ..	51.4	—	Guano	12.1	10.3	2.82
Potash Manure Salts (30%) ..	31.2	—	Complete Fertiliser, I.C.I.	10.3	10.8	20.7
Agricultural Salt ..	—	56.8				

(1) Used in R.F. 1-144, R.W. 1-48, R.O. 1-72, R.B. 1-32.
(2) Used in R.P. 1-162, R.S. 1-48, W.S. 1-144.
(3) Used in R.F. 1-144.
(4) Used in R.P. 1-162, R.S. 1-48, W.S. 1-144.
(5) Used in T.H. 1-25, M.A. 1-150, H.G. 1-25, O.G. 1-25, K.G. 1-16, F.G. 1-25.

FOUR-COURSE ROTATION

Manures.	% Organic matter		% N.		% P_2O_5		% K_2O	
	1930	1931	1930	1931	1930	1931	1930	1931
Chaff	82.2	83.3	0.376	0.273	0.113	0.080	0.625	0.925
Dung	25.5	16.8	0.882	0.498	0.330	0.154	1.44	0.449
Adco	21.1	12.83	0.367	0.330	0.195	0.262	0.287	0.121
Superphosphate	—	—	—	—	17.4	16.7	—	—
Mineral Phosphate (90% through 120 mesh)	—	—	—	—	26.1	26.1	—	—
Muriate of Potash	—	—	—	—	—	—	52.6	51.4
Sulphate of Ammonia ..	—	—	21.2	20.8(1) 21.0(2)	—	—	—	—

(1) Used on all cases except swedes, treatments 4 and 5.
(2) Used for swedes treatments 4 and 5.

SIX-COURSE ROTATION

Manures.	% N.		% P_2O_5		% K_2O	
	1930	1931	1930	1931	1930	1931
Sulphate of Ammonia	20.9	20.8(1) 21.0(2)	—	—	—	—
Superphosphate ..	—	—	17.4	16.7(1) 17.0(2)	—	—
Muriate of Potash	—	—	—	—	51.3	51.4

(1) Used in all cases except potatoes and sugar beet at Rothamsted and Woburn.
(2) Used for potatoes and sugar beet at Rothamsted and Woburn.

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CROPS GROWN IN ROTATION, AGDELL FIELD

PRODUCE PER ACRE.

Year.	Crop.	O. Unmanured since 1848. 5. Fallow.	O. 6. Clover or Beans.	M. Mineral Manure‡ No Nitrogen. 3. Fallow.	M. 4. Clover or Beans.	C. Complete Mineral and Nitrogenous Manure. 1. Fallow.	C. 2. Clover or Beans.
Average of First Twenty-one Courses, 1848-1931.							
	Roots (Swedes) .. cwt.*	32.0	16.1	174.0	206.5	352.0	310.0
	Barley—						
	Dressed Grain bush.	21.6	19.8	22.7	26.6	30.3	35.0
	Total Straw† cwt.	13.3	13.2	13.6	15.6	18.4	21.7
	Beans—						
	Dressed Grain bush.‡‡	—	13.1	—	18.2	—	22.3
	Total Straw cwt.	—	9.2	—	13.2	—	15.3
	Clover Hay cwt.§	—	25.6	—	52.1	—	52.0
	Wheat—						
	Dressed Grain bush.	23.1	21.6	26.9	29.4	27.5	29.0
	Total Straw† .. cwt.	22.9	21.2	28.2	29.8	29.4	29.3
Present Course (21st), 1928, 1929, 1930 and 1931.							
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 Total Straw	75.6	64.5	69.6	48.8	74.7	72.9
1930	Clover Hay (1st Crop) cwt.	—	4.3	—	36.2	—	28.9
	(2nd ,,) cwt.**	—	3.3	—	13.6	—	15.6
1931	Wheat—						
	Dressed Grain bush.	5.0	8.2	3.2	5.6	0.1	2.0
	Offal Grain lb.	60.0	122.5	94.4	61.9	5.0	285.0
	Straw lb.	1170.0	1441.0	1748.0	3000.0	194.0	2064.0
	Total Straw† cwt.	11.8	14.2	20.2	29.1	2.8	20.3
	Wt. of Dressed Grain per bush. lb.	58.6	60.0	58.0	59.9	59.0††	58.2
	Proportion of Total Grain to 100 of Total Straw	26.6	38.4	12.5	12.3	3.2	17.8

* Plots 1, 3 and 5 based upon 19 courses. Plots 2, 4 and 6 based upon 18 courses.
† 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.
** Estimated hay yields, calculated from the dry matter.
†† Estimated from the remaining plots.
‡‡ Based on 8 courses.
§ Based on 13 courses.

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Wheat after Fallow (without Manure, 1851 and since).

Hoos Field, 1931.

	1931	Average 76 years 1856—1931
Dressed Grain { Yield per acre—bushels	12.99	14.20
Dressed Grain { Weight per bushel—lb.	61.1	58.7
Offal Grain per Acre—lb.	100.0	51.1
Straw per Acre—lb.	1270.0	—.
Total straw per Acre—cwt.	14.5	12.5
Proportion of Total Grain to 100 of total Straw	54.9	—

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MANGOLDS AND SWEDES—BARNFIELD, 1931*

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

PRODUCE PER ACRE, MIXED ROOTS.

	Strip.	Wide—normal spacing 26in. (as hitherto). Narrow—spacing of 20in. Strip Manures. (Amounts stated are per acre).		1931. Cross Dressings. O None.	N Nitrate of Soda (550 lb.)	A Sulphate of Ammonia (412 lb.)	AC Sulphate of Ammonia (412 lb.) & Rape Cake	C Rape Cake (2,000 lb.)	50-Year Average, 1876-1928† Cross Dressings. O None.	N Nitrate of Soda (550 lb.)	A Sulphate of Ammonia (412 lb.)	AC Sulphate of Ammonia (412 lb.) & Rape Cake	C Rape Cake (2,000 lb.)
				Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
ROOTS	1	Dung only (14 tons)	Wide	17.47	29.10	23.91	25.67	24.93	17.47	26.16	21.70	23.58	23.53
			Narrow	9.33	17.33	19.32	22.66	15.66					
	2	Dung, Superphosphate (3½ cwt.), Sulphate of Potash (500 lb.)	Wide	19.03	30.14	24.88	25.84	27.44	18.94	26.68	24.71	27.57	26.50
			Narrow	20.25	28.88	24.24	27.65	26.51					
	4	Complete Minerals: Super. and Potash as 2, Salt (200 lb.), Sulphate of Magnesia (200 lb.)	Wide	4.55	(*b*)21.04	15.10	27.75	20.42	4.60	(*a*)17.35 (*b*)17.81‡§	14.37	26.06	20.96
			Narrow	4.47	(*a*)17.16**	15.32	25.46	17.54					
	5	Superphosphate only (3½ cwt.)	Wide	3.64	17.87	12.51	12.13	13.05	4.47	14.63	6.70	9.49	10.16
			Narrow	4.67	18.76	14.60	14.89	14.38					
	6	Super. (3½ cwt.) Sulphate of Potash (500 lb.) ..	Wide	3.52	16.32	14.62	21.89	15.70	4.03	15.12	13.50	22.55	18.14
			Narrow	3.62	19.05	15.00	24.81	15.08					
	7	Super (3½ cwt.) Sulphate of Magnesia (200 lb.) & Sodium Chloride (200 lb.)	Wide	2.73	16.84	16.92	21.99	19.68	4.86	16.04	14.70	22.31	19.10
			Narrow	3.26	20.03	16.28	22.97	16.92					
	8	No Mineral	Wide	1.31	11.25	11.34	15.27	13.14	3.34	9.61	5.32	8.52	8.89
			Narrow	2.08	15.80	15.14	17.87	16.24					
	9	Sodium Chloride (200 lb.)., Nit. Soda (550 lb.), Sulph. Potash (500 lb.) and Sulph. Mag. (200 lb.)	Wide	16.23	—	—	—	—	—	—	—	—	—
			Narrow	16.00	—	—	—	—					
LEAVES	1	Dung only (14 tons)	Wide	5.66	9.05	8.81	8.68	7.42	3.04	4.65	4.93	5.25	4.54
			Narrow	3.27	5.61	7.22	6.82	4.75					
	2	Dung, Superphosphate (3½ cwt.), Sulphate of Potash (500 lb.)	Wide	5.14	8.73	6.80	6.68	6.84	3.16	5.15	5.49	6.29	4.80
			Narrow	6.30	10.13	8.58	9.03	8.07					
	4	Complete Minerals: Super. and Potash as 2, Salt (200 lb.) Sulphate of Magnesia (200 lb.)	Wide	1.01	(*b*) 8.16	4.44	7.23	4.82	1.04	(*a*) 3.87 (*b*) 4.09‡§	2.88	5.33	3.37
			Narrow	0.95	(*a*) 6.67	3.96	7.80	4.34					
	5	Superphosphate only (3½ cwt.)	Wide	0.92	5.61	4.45	7.42	4.83	1.05	3.19	2.61	3.29	2.84
			Narrow	0.84	6.04	4.44	8.20	4.47					
	6	Super. (3½ cwt.) Sulphate of Potash (500 lb.)	Wide	0.83	4.85	2.94	6.63	3.85	0.93	3.04	2.81	5.20	2.87
			Narrow	0.94	5.58	3.44	7.02	3.66					
	7	Super. (3½ cwt.) Sulphate of Magnesia (200 lb.) and Sodium Chloride (200 lb.) ..	Wide	0.84	4.95	3.67	8.44	5.30	1.10	3.31	3.01	5.23	3.31
			Narrow	0.85	6.37	4.17	7.58	4.24					
	8	No Minerals	Wide	0.51	3.33	3.22	6.76	4.87	0.98	3.19	2.52	3.30	2.84
			Narrow	0.87	4.82	3.54	7.52	5.47					
	9	Sodium Chloride (200 lb.), Nit. Soda (550 lb.), Sulph. Potash (500 lb.) and Sulph. Mag. (200 lb.)	Wide	3.49	—	—	—	—	—	—	—	—	—
			Narrow	3.31	—	—	—	—					

* The first sowing of Mangolds failed. For the second sowing a mixture of Mangolds and Swedes was used.

** From 1904 onwards plot 4N has been divided, 4(*a*) receiving Superphosphate, Sulphate of Potash, Sulphate of Magnesia, Sodium Chloride and Nitrate of Soda, amounts as above; 4(*b*) receiving Superphosphate, 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. For this period the average yield of plot 4(*a*) was 18.11 for roots and 4.05 for leaves.

‡ Normal spacing.

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MANGOLDS AND SWEDES—BARNFIELD, 1931 (*Continued*)

PERCENTAGE YIELD AND PLANT NUMBER OF MANGOLDS.

Strip.		Yield of Mangolds Expressed as Percentage of Total Yield. ROOTS. Cross Dressings.					Yield of Mangolds Expressed as Percentage of Total Yield. LEAVES. Cross Dressings.					Plant Number of Mangolds Expressed as Percentage of Total Plant Number. Cross Dressings.				
		O	N	A	AC	C	O	N	A	AC	C	O	N	A	AC	C
		None.	Nitrate of Soda (550 lb.)	Sulphate of Ammonia (412 lb.)	Sulphate of Ammonia (412 lb.) and Rape Cake	Rape Cake (2,000 lb.)	None	Nitrate of Soda (550 lb.)	Sulphate of Ammonia (412 lb.)	Sulphate of Ammonia (412 lb.) and Rape Cake.	Rape Cake (2,000 lb.)	None	Nitrate of Soda (550 lb.)	Sulphate of Ammonia (412 lb.)	Sulphate of Ammonia (412 lb.) and Rape Cake	Rape Cake (2,000 lb.)
1	Wide	95.4	97.2	91.8	89.5	96.1	97.2	97.8	94.3	92.1	97.4	96.7	97.6	95.9	96.1	97.6
	Narrow	87.7	92.9	66.6	16.3	77.6	93.4	95.4	71.8	21.4	85.5	94.2	94.8	83.6	61.9	88.3
2	Wide	99.5	97.8	94.5	96.6	99.1	99.7	98.7	96.4	97.4	99.5	98.8	99.0	97.6	98.5	99.2
	Narrow	86.7	93.3	87.7	89.0	94.8	93.3	95.7	93.1	92.0	96.7	95.9	95.9	94.8	95.0	97.0
4	Wide	56.3	89.0	72.6	84.0	84.6	75.4	80.7	84.2	88.2	89.3	84.3	94.0	86.4	90.2	90.9
	Narrow	63.8	79.6	66.2	81.3	84.4	78.9	88.9	82.4	87.7	89.2	88.4	89.5	88.0	90.7	91.5
5	Wide	57.7	76.2	39.1	45.2	57.2	76.7	83.3	56.2	52.9	68.4	87.9	90.8	81.0	81.5	85.7
	Narrow	58.3	73.5	35.6	44.0	50.7	68.5	83.5	52.4	49.5	64.2	84.7	89.0	77.6	78.6	83.3
6	Wide	38.0	90.7	50.5	63.7	85.5	65.6	95.2	68.2	74.6	90.3	78.4	93.2	80.4	85.6	91.8
	Narrow	35.2	79.5	53.8	68.2	82.6	66.2	89.8	70.1	78.3	87.5	80.0	90.7	83.2	87.1	90.5
7	Wide	48.3	76.0	53.8	64.7	78.5	76.6	85.7	68.4	65.9	84.1	82.9	89.0	82.1	83.4	90.2
	Narrow	35.1	72.8	55.7	57.4	77.4	63.2	83.9	71.7	64.9	83.5	77.2	87.8	81.6	80.9	87.8
8	Wide	41.0	49.3	21.9	21.6	43.0	69.4	65.1	41.1	33.0	59.1	75.0	75.0	69.8	73.1	80.1
	Narrow	65.5	51.7	12.8	18.7	31.6	87.7	66.1	26.5	30.1	49.8	83.4	75.6	66.3	67.3	75.9
9	Wide	57.4	—	—	—	—	83.2	—	—	—	—	81.4	—	—	—	—
	Narrow	47.1	—	—	—	—	64.6	—	—	—	—	71.7	—	—	—	—

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HAY—THE PARK GRASS PLOTS

Plot.	Manuring (amounts stated are per acre).		1931. Yield of Hay per acre. 1st Crop.	2nd* Crop.	Total.	1931. Dry Matter per acre. 1st Crop.	2nd Crop.	Total.	Plot.
			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	22.5	12.3	34.8	2138	1103	3241	1
		limed ..	19.8	8.8	28.6	1886	789	2675	
2	Unmanured (after Dung 8 years, 1856–63) ..	not limed	16.0	6.2	22.2	1501	559	2060	2
		limed ..	18.1	6.7	24.8	1690	601	2291	
3	Unmanured	not limed	12.1	6.1	18.2	1094	544	1638	3
		limed ..	14.5	5.4	19.9	1314	488	1802	
4-1	Superphosphate of Lime (3½ cwt.)	not limed	25.3	9.2	34.5	2442	820	3262	4-1
		limed ..	20.9	4.0	24.9	1982	357	2339	
4-2	Superphosphate of Lime (3½ cwt.) and double dressing (412 lb.) Sulphate of Ammonia (=86 lb. N.)	not limed	20.3	8.9	29.2	1897	794	2691	4-2
		limed	33.2	9.9	43.1	3250	890	4140	
5-1	(N. half) Unmanured following double dressing Amm. salts (=86 lb. N.) 1856–97	not limed	21.1	10.8	31.9	2113	968	3081	5-1
5-2	(S. half) Superphosphate (3½ cwt.) Sulphate of Potash (500 lb.); following double dressing Amm. salts (=86 lb. N.) 1856–97	not limed	24.3	11.6	35.9	2326	1040	3366	5-2
6	Complete Mineral Manure as Plot 7; following double dressing Amm. salts (=86 lb. N.) 1856–68	not limed	28.3	15.0	43.3	2776	1343	4119	6
7	Complete Mineral Manure: Super. (3½ cwt.); Sulphate of Potash (500 lb.); Sulphate of Soda (100 lb.); Sulphate of Magnesia (100 lb.) ..	not limed	31.6	13.2	44.8	2946	1185	4131	7
		limed ..	36.2	13.8	50.0	3310	1232	4542	
8	Mineral Manure without Potash	not limed	23.6	10.5	34.1	2308	943	3251	8
		limed ..	21.5	10.6	32.1	2085	951	3036	
9	Complete Mineral Manure and double dressing (412 lb.) Sulphate of Ammonia (=86 lb. N.) ..	not limed	55.9	25.9	81.8	5320	2319	7639	9
		limed ..	63.1	22.9	86.0	5992	2052	8044	
10	Mineral Manure (without Potash) and double dressing Amm. salts (=86 lb. N.)	not limed	36.6	15.8	52.4	3594	1414	5008	10
		limed ..	40.7	15.8	56.5	4110	1412	5522	
11-1	Complete Mineral Manure and treble dressing (618 lb.) Sulphate of Ammonia (129 lb. N.) ..	not limed	49.7	27.6	77.3	5849	2474	8323	11-1
		limed ..	65.1	22.0	87.1	5917	1972	7889	
11-2	As Plot 11-1 and Silicate of Soda	not limed	54.4	32.4	86.8	4798	2900	7698	11-2
		limed ..	67.7	27.3	95.0	5884	2444	8328	
12	Unmanured	not limed	17.0	6.6	23.6	1592	590	2182	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	51.9	21.9	73.8	4928	1966	6894	13
		limed ..	50.9	18.8	69.7	4751	1680	6431	
14	Complete Mineral Manure and double dressing (550 lb.) Nitrate of Soda (=86lb. N.) ..	not limed	56.3	23.3	79.6	5396	2088	7484	14
		limed (sun)	51.1	18.8	69.9	4961	1682	6643	
		lmd (shade)	37.5	12.1	49.6	3376	1081	4457	
15	Complete Mineral Manure as Plot 7; following double dressing Nitrate of Soda (=86 lb. N., 1858–75)	not limed	32.3	14.1	46.4	3056	1263	4319	15
		limed ..	31.6	9.5	41.1	2989	848	3837	
16	Complete Mineral Manure and Single Dressing (275 lb.) Nitrate of Soda (= 43 lb. N.)	not limed	41.7	13.0	54.7	3798	1163	4961	16
		limed	33.4	10.8	44.2	3133	965	4098	
17	Single dressing (275 lb.) Nitrate of Soda (=43lb. N.)	not limed	24.4	8.3	32.7	1749	741	2490	17
		limed ..	25.6	7.1	32.7	2376	638	3014	
18	Mineral Manure (without Super.), and double dressing Sulphate of Amm. (=86 lb. N.), 1905 and since; following Minerals and Amm. salts supplying the constituents of 1 ton of Hay, 1865–1904..	not limed	35.4	23.5	58.9	3465	2106	5571	18
		limed (6788 lb.)	49.4	17.2	66.6	4541	1540	6081	
		limed (3951 lb.)	37.3	15.9	53.2	3434	1429	4863	
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	26.8	17.4	44.2	2530	1562	4092	19
		limed (3150 lb.)	23.6	12.1	35.7	2194	1082	3276	
		limed (570 lb.)	25.0	15.8	40.8	2292	1412	3704	
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	41.6	17.1	58.7	4015	1529	5544	20
		limed (2772 lb.)	39.1	14.7	53.8	3698	1319	5017	
		limed (570 lb.)	37.8	18.0	55.8	3627	1618	5245	

Ground Lime was applied to the southern portion (limed) of the plots at the rate of 2,000 lb. to the acre in the Winters of 1903–4, 1907–8, 1915–16, 1923–24, 1927–28, and at the rate of 2,500 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.

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PARK GRASS PLOTS
BOTANICAL COMPOSITION PER CENT.
1926 (1st Crop)

Plot	Manuring.	Liming	Gramineæ	Leguminosæ	Other Orders	"Other Orders" consist largely of
3	Unmanured.	Limed	61.7	7.8	30.5	*Plantago lanceolata*
		Unlimed	49.6	6.1	44.3	*Plantago lanceolata*
7	Complete Mineral Manure.	Limed	81.5	4.8	13.7	*Heracleum sphondylium*
		Unlimed	73.3	6.2	20.5	*Achillea millefolium*
9	Complete Mineral Manure and double Amm. Salts.	Limed	98.7	0.1	1.2	*Rumex acetosa*
		Unlimed	99.6	—	0.4	*Heracleum sphondylium*
14	Complete Mineral Manure and double Nitrate of Soda.	Limed (sun)	95.0	0.6	4.4	*Taraxacum vulgare* *Anthriscus sylvestris* *Rumex acetosa*
		Limed (Shade)	94.8	1.8	3.4	*Anthriscus sylvestris*
		Unlimed	97.9	0.1	2.0	*Anthriscus sylvestris* *Rumex acetosa*
15	As plot 7 following double Nitrate of Soda, 1858-75.	Limed	Not analysed.			—
		Unlimed				—
17	Single Nitrate of Soda.	Limed				—
		Unlimed				—
18	Mineral Manure (without Super) and double Sulphate Amm. 1905 and since	L. 6,788 lb.	93.8	0.1	6.1	*Rumex acetosa*
		L. 3,951 lb.	89.5	0.1	10.4	*Rumex acetosa*
		Unlimed	77.8	—	22.2	*Rumex acetosa*
19	Farmyard Dung in 1905 and every fourth year since (omitted 1917).	L. 3,150 lb.	90.4	1.2	8.4	*Rumex acetosa* *Ranunculus spp.*
		L. 570 lb.	84.1	1.6	14.3	*Rumex acetosa* *Ranunculus spp.*
		Unlimed	84.8	2.5	12.7	*Rumex acetosa* *Ranunculus spp.*
20	Farmyard Dung in 1905 and every fourth year since (omitted in 1917) each intervening year Sulphate of potash, Super., and Nitrate of Soda.	L. 2,772 lb.	87.6	3.5	8.9	*Ranunculus spp.* *Rumex acetosa* *Taraxacum vulgare*
		L. 570 lb.	90.6	1.2	8.2	*Ranunculus spp.* *Rumex acetosa* *Taraxacum vulgare*
		Unlimed	87.7	3.8	8.5	*Ranunculus spp.* *Rumex acetosa*

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PARK GRASS PLOTS
BOTANICAL COMPOSITION PER CENT.
1927 (1st Crop)

Plot	Manuring	Liming	Gramineæ	Leguminosæ	Other Orders	"Other orders" consist largely of
3	Unmanured.	Limed	62.4	4.4	33.2	*Plantago lanceolata*
		Unlimed	71.3	2.4	26.3	—
7	Complete Mineral Manure.	Limed	62.7	25.3	12.0	—
		Unlimed	69.4	9.7	20.9	—
9	Complete Mineral Manure and double Amm. Salts.	Limed	99.1	0.3	0.6	—
		Unlimed	99.3	—	0.7	*Heracleum sphondylium*
14	Complete Mineral Manure and Double Nitrate of Soda.	Limed (sun)	96.2	1.6	2.2	—
		Limed (shade)				
		Unlimed	97.4	1.0	1.6	*Taraxacum vulgare*
15	As plot 7 following double Nitrate of Soda, 1858-75.	Limed	58.3	28.7	13.0	*Plantago lanceolata* *Achillea millefolium*
		Unlimed	74.9	5.9	19.2	*Achillea millefolium* *Plantago lanceolata*
17	Single Nitrate of Soda.	Limed	82.4	1.3	16.3	*Plantago lanceolata*
		Unlimed	76.0	0.1	23.9	*Plantago lanceolata*
18	Mineral Manure (without Super.) and double Sulphate Amm. 1905 and since.	L. 6,788 lb.	97.7	0.1	2.2	*Heracleum sphondylium* *Rumex acetosa*
		L. 3,951 lb.	97.0	—	3.0	*Achillea millefolium* *Rumex acetosa*
		Unlimed	98.2	—	1.8	*Rumex acetosa*
19	Farmyard Dung in 1905 and every fourth year since (omitted 1917).	L. 3,150 lb.	87.9	3.0	9.1	*Heracleum sphondylium* *Ranunculus spp.*
		L. 570 lb.	88.0	2.1	9.9	*Ranunculus spp.* *Rumex acetosa*
		Unlimed	90.3	1.3	8.4	*Rumex acetosa*
20	Farmyard Dung in 1905 and every fourth year since (omitted in 1917) each intervening year Sulphate of Potash, Super., and Nitrate of Soda.	L. 2,772 lb.	88.8	3.5	7.7	*Centaurea nigra* *Taraxacum vulgare*
		L. 570 lb.	94.3	0.6	5.1	*Centaurea nigra* *Conopodium denudatum*
		Unlimed	93.2	1.8	5.0	*Rumex acetosa*

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WHEAT—BROADBALK FIELD, 1931

Plot.	Manurial Treatment (amounts stated are per acre).	Dressed Grain, bushels per acre (in some cases estimated from half or quarter-bushel)[1]				Total Grain, cwt. per acre.				74-year Average 1852-1925 (prior to fallow). Total Grain, cwt.
		II	III	IV	V	II	III	IV	V	
2A	Farmyard Manure (14 tons)	14.0	18.4	22.1	18.9	9.6	11.9	14.7	12.8	16.3**
2B	Farmyard Manure (14 tons)	13.5	20.1	23.4	22.2	9.3	13.0	15.2	14.3	19.4
3	Unmanured since 1839	5.9	5.7	4.3	10.8	4.2	3.7	3.0	7.0	6.7
5	Complete Mineral Manure §§	7.6	3.7	8.5	10.3	5.4	2.6	5.9	7.4	7.8
6	As 5, and 206 lb. Sulphate of Ammonia	13.2	17.8	18.6	14.2	8.0	10.4	10.8	9.1	12.5
7	As 5, and 412 lb. Sulphate of Ammonia	14.0	27.0	20.2	14.5	9.4	17.5	13.3	9.5	17.6
8	As 5, and 618 lb. Sulphate of Ammonia	15.0	20.5	19.1	14.6	10.2	14.1	13.4	11.0	20.1
9	As 5, and 275 lb. Nitrate of Soda	14.9	21.4	20.3	16.4	9.6	13.4	12.5	10.3	13.9††
10	412 lb. Sulphate of Ammonia	20.8	28.7	26.0	24.3	12.6	17.0	16.1	15.2	10.9
11	As 10, and Superphosphate (3½ cwt.)	23.8	31.2	29.8	25.8	14.8	18.8	18.1	16.0	12.3
12	As 10, and Super. (3½ cwt.) and Sulph. Soda (366 lb.)	21.4	30.2	33.0	19.6	13.5	18.3	20.3	12.8	15.7
13	As 10, and Super. (3½ cwt.) and Sulph. Potash (200 lb.)	15.7	21.8	24.5	13.9	9.8	14.2	15.3	9.4	17.0
14	As 10, and Super. (3½ cwt.) and Sulph. Magnesia (280 lb.)	14.3	31.2	29.9	13.2	9.8	19.1	18.6	9.1	15.5
15	As 5, and 412 lb. Sulphate of Ammonia all applied in Autumn	19.6	25.1	17.1	19.7	11.6	15.0	11.8	11.9	16.1
16	As 5, and 550 lb. Nitrate of Soda	16.3	23.0	22.8	15.8	10.9	14.9	14.5	10.7	17.8††
17	Minerals alone as 5 or 412 lb. Sulphate of Ammonia	M 9.7	9.0	9.3	3.7	6.0	5.5	5.7	2.4	M8.1
18	alone in alternate years	A20.0	26.2	19.2	12.1	12.8	16.7	12.7	8.6	A16.1 *
19	Rape Cake (1,889 lb.)	20.4	23.3	23.9	14.9	12.8	14.8	15.5	9.6	12.6‡
20	As 7, without Super.	14.5	—	—	—	8.7	—	—	—	10.3§

For notes see p. 126.

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WHEAT—BROADBALK FIELD, 1931

Plot.	Manurial Treatment (amounts stated are per acre).	Bushel Weight in lb. (in some cases estimated from half or quarter-bushel)				Total Straw†, cwt. per acre.				74-year Average 1852-1925 (prior to fallow). Total Straw, cwt.
		II	III	IV	V	II	III	IV	V	
2A	Farmyard Manure (14 tons)	58.0	59.8	60.0	59.8	37.1	45.2	46.0	47.1	32.1**
2B	Farmyard Manure (14 tons)	58.5	60.8	60.5	60.8	43.3	40.5	42.4	44.9	34.2
3	Unmanured since 1839	59.0	59.5	62.0	60.5	10.4	7.8	6.2	12.3	9.8
5	Complete Mineral Manure §§	58.5	62.0	59.8	60.5	14.2	5.2	10.9	15.6	11.5
6	As 5, and 206 lb. Sulphate of Ammonia	58.2	59.5	59.5	60.5	22.3	22.5	23.5	22.0	20.3
7	As 5, and 412 lb. Sulphate of Ammonia	58.5	60.0	59.9	59.5	33.7	47.7	46.2	49.2	32.1
8	As 5, and 618 lb. Sulphate of Ammonia	58.5	58.4	58.2	58.0	50.6	57.7	57.1	59.5	39.8
9	As 5, and 275 lb. Nitrate of Soda	58.8	60.2	60.0	60.0	28.3	34.8	33.6	37.3	24.6††
10	412 lb. Sulphate of Ammonia	59.2	59.8	59.8	59.8	29.2	37.4	37.8	39.1	17.8
11	As 10, and Superphosphate (3½ cwt.)	59.5	59.7	59.8	59.5	31.8	40.5	40.5	39.6	21.4
12	As 10, and Super. (3½ cwt.) and Sulph. Soda (366 lb.)	58.9	59.8	59.7	59.2	35.2	41.5	45.5	42.8	26.8
13	As 10, and Super. (3½ cwt.) and Sulph. Potash (200 lb.)	59.5	60.8	59.5	58.8	35.7	40.8	47.5	49.5	30.6
14	As 10, and Super. (3½ cwt.) and Sulph. Magnesia (280 lb.)	60.2	59.8	60.2	58.8	31.8	41.8	45.9	43.1	26.8
15	As 5, and 412 lb. Sulphate of Ammonia all applied in Autumn	59.9	60.8	61.5	60.8	28.7	30.3	31.6	29.3	28.2
16	As 5, and 550 lb. Nitrate of Soda	60.5	60.9	60.4	58.2	45.3	51.3	51.9	51.2	35.2††
17	Minerals alone as 5 or 412 lb. Sulphate of Ammonia alone in alternate years	M60.5	60.5	60.5	63.0	13.0	11.0	13.6	10.9	M12.3
18		A60.8	60.9	61.0	60.0	36.6	41.3	41.0	44.8	A28.1*
19	Rape Cake (1,889 lb.)	60.8	59.8	60.9	60.0	27.7	33.2	39.4	30.5	22.0‡
20	As 7, without Super	58.0	—	—	—	27.5	—	—	—	18.6§

† Includes straw, cavings, and chaff. *A=Ammonia series, M=Mineral series.
** 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 (IV and V) the upper part (I, II and III) 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 (I and II) was sown with wheat, and again in 1928, while in 1929 the whole field was sown, and harvested in 1930 in five separate portions. In 1931 Section I was fallowed.

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BARLEY—HOOS FIELD, 1930

Corrected results to replace Table on p. 124 of 1930 Report.

As in 1929 the rows were widely spaced to facilitate weed control. In 1930, however, the field was sown longitudinally with a row spacing of 18 inches, instead of the 24 inch spacing adopted in 1929. The two varieties were sown by the half-drill strip method, and to equalise the area certain rows at the sides of each plot were not included in the weighed produce. In computing the yields per acre the whole area harvested experimentally was unfortunately taken as being the area occupied by each variety separately; the yields per acre published in the 1930 Report were therefore half what they should have been.

Plot	Manuring (Amounts stated are per acre)	Total Grain per acre		76 Years' Average 1852-1928 Dressed Grain per acre.	Total Straw per acre.		76 Years Average 1852-1928 Total Straw per acre.
		Plumage Archer	Spratt Archer		Plumage Archer	Spratt Arcner	
		cwt.	cwt.	bush.‖	cwt.	cwt.	cwt.†
1O	Unmanured	0.7	0.7	13.4	1.9	1.6	7.8
2O	Superphosphate only (3½ cwt.) ..	9.8	9.1	19.0	8.2	7.6	9.8
3O	Alkali Salts only (200 lb. Sulphate of Potash; 100 lb. Sulphate of Soda; 100 lb. Sulphate of Magnesia)	3.6	3.0	14.3	5.6	4.3	8.7
4O	Complete Minerals; as 3O with Superphosphate (3½ cwt.) ..	7.2	9.5	19.0	6.7	8.1	11.2
5O	Potash (200 lb.) and Superphosphate (3½ cwt.)	8.4	8.3	15.5	8.3	9.2	9.4
1A	Ammonium Salts only (206 lb. Sulphate of Ammonia)	2.9	4.1	23.7	4.3	6.6	13.7
2A	Superphosphate and Amm. Salts ..	18.0	18.9	35.8	17.7	16.8	20.4
3A	Alkali Salts and Amm. Salts ..	7.8	5.3	25.8	11.1	8.2	16.0
4A	Complete Minerals and Amm. Salts	14.8	17.7	39.3	16.9	17.3	23.6
5A	Potash, Super. and Amm. Salts ..	13.3	12.1	33.8	19.4	17.3	21.7
1AA	Nitrate of Soda only (275 lb.) ..	4.7	4.8	24.3*	8.6	8.3	15.4*
2AA	Superphosphate and Nitrate of Soda	18.1	19.0	38.8*	18.6	18.8	23.1*
3AA	Alkali Salts and Nitrate of Soda ..	8.0	8.0	24.5*	11.0	10.9	16.6*
4AA	Complete Minerals and Nitrate of Soda	17.0	17.4	37.7*	18.7	16.9	23.6*
1AAS	As Plot 1AA and Silicate of Soda (400 lb.)	6.9	11.0	30.2*	7.6	13.4	18.2*
2AAS	As Plot 2AA and Silicate of Soda (400 lb.)	20.5	21.4	39.7*	21.1	22.4	23.9*
3AAS	As Plot 3AA and Silicate of Soda (400 lb.)	12.8	13.5	31.2*	14.3	14.2	19.9*
4AAS	As Plot 4AA and Silicate of Soda (400 lb.)	19.2	21.0	39.9*	20.7	20.8	25.4*
1C	Rape Cake only (1,000 lb.) ..	11.9	12.5	35.5	13.3	12.9	20.6
2C	Superphosphate and Rape Cake ..	18.0	18.1	38.1	21.3	19.8	22.0
3C	Alkali Salts and Rape Cake ..	14.6	16.4	33.7	19.1	18.6	20.4
4C	Complete Minerals and Rape Cake	16.6	17.8	37.5	19.9	20.2	22.6
7-1	Unmanured (after dung (14 tons) for 20 years (1852–71) ..	7.9	9.8	22.5‡	8.8	10.1	13.5‡
7-2	Farmyard Manure (14 tons) ..	15.3	16.3	44.6	18.2	19.9	28.1
6-1	Unmanured since 1852	3.3	1.9	14.7	5.4	4.6	8.6
6-2	Ashes from Laboratory furnace ..	4.6	5.7	15.7	5.4	6.6	9.3
1N	Nitrate of Soda only (275 lb.) ..	4.2	3.4	28.7§	5.2	4.8	17.8§
2N	Nitrate of Soda only (275 lb.) ..	13.5	10.3	31.7§§	17.5	14.4	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.

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BARLEY—HOOS FIELD, 1931

Plot.	Manuring. (Amounts stated are per acre).	Dressed Grain, bushels per acre (in some cases estimated from half or quarter bushel).		Total Grain, cwt. per acre.		76 Years' Average, 1852-1928 Dressed Grain per acre bush.‖	Bushel Weight in lb. (in some cases estimated from half or quarter bushel).		Total Straw, cwt. per acre.		76 Years' Average, 1852-1928 Total Straw per acre cwt.†
		Plumage Archer.	Spratt Archer.	Plumage Archer.	Spratt Archer.		Plumage Archer.	Spratt Archer.	Plumage Archer.	Spratt Archer.	
1O	Unmanured	12.6	17.4	6.0	8.2	13.4	51.5	51.2	10.6	13.0	7.8
2O	Superphosphate only (3½ cwt.)	16.4	16.4	7.9	7.9	19.0	52.5	53.2	11.5	17.9	9.8
3O	Alkali Salts only (200 lb. Sulphate of Potash; 100 lb. Sulphate of Soda; 100 lb. Sulphate of Magnesia	8.8	16.8	4.3	8.2	14.3	54.0	53.0	9.6	13.1	8.7
4O	Complete Minerals; as 3O with Superphosphate (3½ cwt.)	22.8	25.6	11.0	12.4	19.0	53.0	53.1	14.7	18.7	11.2
5O	Potash (200 lb.) and Superphosphate (3½ cwt.)	14.1	21.4	7.2	10.7	15.5	55.0	54.5	11.0	13.0	9.4
1A	Ammonium Salts only (206 lb. Sulphate of Ammonia)	8.9	12.9	5.8	7.6	23.7	54.0	53.0	12.7	14.4	13.7
2A	Superphosphate and Amm. Salts	25.7	31.0	13.8	16.4	35.8	53.2	53.0	19.0	17.5	20.4
3A	Alkali Salts and Amm. Salts	3.6††	13.3	2.4	7.9	25.8	—	54.0	15.4	13.9	16.0
4A	Complete Minerals and Amm. Salts	27.3	37.6	14.6	20.0	39.3	54.5	55.4	19.2	19.1	23.6
5A	Potash, Super. and Amm. Salts	26.1	30.3	12.8	14.9	33.8	53.5	53.8	19.0	21.3	21.7
**1AA	Nitrate of Soda only (275 lb.)	11.2	22.1	6.5	12.2	24.3*	54.5	54.4	18.2	16.3	15.4*
1AAS	As 1AA and Silicate of Soda (400 lb.)					30.2*					18.2*
**2AA	Superphosphate and Nitrate of Soda	28.0	36.1	14.6	19.0	38.8*	53.2	54.2	19.0	18.7	23.1*
2AAS	As 2AA and Silicate of Soda (400 lb.)					39.7*					23.9*
**3AA	Alkali Salts and Nitrate of Soda	7.7	20.6	4.7	11.6	24.5*	53.5	53.6	15.9	15.4	16.6*
3AAS	As 3AA and Silicate of Soda (400 lb.)					31.2*					19.9*
**4AA	Complete Minerals and Nitrate of Soda	29.7	38.3	16.0	20.5	37.7*	54.1	54.9	16.4	21.0	23.6*
4AAS	As 4AA and Silicate of Soda (400 lb.)					39.9*					25.4*
1C	Rape Cake only (1,000 lb.)	25.3	34.3	13.8	18.2	35.5	55.0	54.6	17.8	19.7	20.6
2C	Superphosphate and Rape Cake	32.3	41.8	17.1	22.4	38.1	54.0	55.2	22.9	21.8	22.0
3C	Alkali Salts and Rape Cake	15.8	30.0	8.9	16.2	33.7	54.5	55.4	13.0	18.3	20.4
4C	Complete Minerals and Rape Cake	31.0	37.3	16.7	20.5	37.5	55.2	55.5	18.3	21.4	22.6
7-1	Unmanured after dung (14 tons) for 20 years (1852-71)	29.8	35.2	14.5	16.8	22.5‡	53.2	52.8	21.4	23.3	13.5‡
7-2	Farmyard Manure (14 tons)	31.9	41.6	17.6	23.4	44.6	54.2	55.4	26.8	32.6	28.1
6-1	Unmanured since 1852	11.6††	15.8	5.8	7.6	14.7	—	52.5	9.9	11.6	8.6
6-2	Ashes from Laboratory furnace	9.3	15.9	4.7	7.7	15.7	53.0	52.0	8.8	12.3	9.3
1N	Nitrate of Soda only (275 lb.)	13.7††	16.8	6.8	8.5	28.7§	—	55.0	11.3	13.9	17.8§
2N	Nitrate of Soda only (275 lb.)	22.9	28.7	11.1	13.8	31.7§§	53.0	53.2	17.7	22.0	20.0§§

‖ 1 cwt. 2.15 bushels. 1912, all plots were fallowed. † Total straw includes straw, cavings and chaff. * Sixty years, 1868-1928. ‡ 56 years, 1872-1928. § 75 years, 1853-1928.
§§ 69 years, 1859-1928. ** Produce from the pairs of these plots bulked together. †† Estimated.
In 1931 the same procedure of sowing in widely spaced drills (18 inches apart) was adopted as in 1930. The two varieties were again sown by the half-drill strip method, the whole of the area of each variety being included in the weighed produce.

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SCHEME FOR CONTINUOUS ROTATION EXPERIMENTS COMMENCING 1930

FOUR COURSE ROTATION EXPERIMENT, ROTHAMSTED.

The Rotation experiment in Great Hoos field was designed primarily for investigating the residual effects of certain humic and phosphatic fertilisers. Previous rotation experiments, at Rothamsted and elsewhere, suffered from a radical defect in design, which resulted in large experimental errors. The arrangement of these experiments was such that with the same crop, the same treatment fell repeatedly on the same plot of land, and repetitions thus did nothing to eliminate permanent soil differences between the plots. The present experiment avoids this defect by ensuring that the period of the cycle of crop rotation differs from the period of the cycle of manurial treatment.

The cropping follows a Norfolk Rotation, involving a four year cycle of barley, seeds, wheat, swedes.* The seeds mixture is Commercial White Clover and Italian Rye-grass, selected in order to lessen the risk of Clover sickness. To minimise the risk of Frit-fly attack in the subsequent wheat crop, the seeds ley is ploughed in before the middle of August.

There are four areas (termed " Series "), each bearing one crop of the rotation, so that all four crops are represented annually.

Treatments.

The treatments compared are :

Humic fertilisers	1.	Dung.
	2.	Adco. compost.
	3.	Straw and Artificials.
Phosphatic fertilisers	4.	Superphosphate.
	5.	Rock phosphate (Gafsa).

Any given plot receives always the same treatment, but the treatment is applied to the plot only once in five years. The period of the manurial cycle (five years) thus differs from that of the crop rotation (four years).

Information is thus obtained of the effect of the fertilisers, not only in the year of application, but also in the first, second, third and fourth years after application.

Each " series " of the experiment comprises twenty-five plots, and in the fifth year of the experiment and in succeeding years, all plots will have been treated, and there will be represented for each treatment plots which have had application of fertilisers in the current year, and one, two, three, and four years previously. The harvest results for 1930-33, therefore, belong to the preparatory period, and will not be included in the final analysis.

There is no replication in any one year, but this will be provided by carrying on the experiment over a fixed period. In twenty years, on any given plot each stage of the treatment will have occurred once with every crop.

The quantities of fertilisers to be applied are calculated as follows :

Dung and Adco are each given in quantities which supply 50 cwt. of organic matter per acre. As much straw is applied as went to make the calculated amount of Adco, *i.e.*, that amount which gives 50 cwt. of organic matter per acre in the form of Adco. The quantity of straw applied will in general give a considerably greater amount of organic matter than the Dung or Adco, since there is a loss of organic matter during the maturation of these fertilisers.

The Adco is made in a pit or bin, so that there is no outside unrotted portion. To prevent straw (applied as chaff) blowing away, it is thoroughly soaked before application, and moistened subsequently if necessary.

The nutrient-content of the three humic fertilisers is equalised by adding sulphate of ammonia, muriate of potash and superphosphate, to raise the applications to 1.8 cwt. N per acre, 3.0 cwt. K_2O per acre, and 1.2 cwt. P_2O_5 per acre. The artificials given with the straw are applied in three doses, to minimise loss by leaching.

The phosphatic fertilisers of treatments 4 and 5 are given at the rate of 1.2 cwt. total P_2O_5 per acre, and with them are given sulphate of ammonia at the rate of 1.8 cwt. N per acre, and muriate of potash at the rate of 3.0 cwt. K_2O per acre.

The rock phosphate is Gafsa, ground so that 90 per cent. passes through the 120 mesh.

The artificials given with the humic fertilisers are all applied with them in the first year of the manurial cycle.

The phosphatic fertilisers of treatments 4 and 5 are applied only in the first year of the manurial cycle, but the accompanying sulphate of ammonia and muriate of potash are applied one fifth annually throughout the cycle.

* It has been decided to substitute potatoes for swedes in 1932 and following years.

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Time of Application of Fertilisers.

In determining the time of application of the fertilisers, the principle followed has been to give the fertilisers to each crop at a time when they are likely to be most effective.

The scheme adopted is as follows :

(1) *Wheat.*—Dung and Adco and accompanying artificials in one dose in the Autumn.

Straw in one dose in Autumn, but accompanying artificials split into three doses, one applied in Autumn, the remainder through the Winter.

Treatments 4 and 5. Phosphates and potash in seed-bed.

Sulphate of Ammonia of treatments 4 and 5, split into two parts, one applied in the seed-bed, the other as a spring top dressing.

(2) *Clover.*—Dung and Adco and accompanying artificials in one dose in Autumn, unless plant is very weak, when the manures should be split into two or three doses.

Straw and artificials—application to be determined by state of plant, but to be completed by the end of January.

Treatments 4 and 5. Phosphates and potash in the Autumn.

Sulphate of Ammonia in two doses, one in Autumn, and one in Spring.

(3) *Barley and Swedes.*—Dung and Adco and accompanying artificials in one dose in Autumn.

Straw in one dose in Autumn, and accompanying artificials in three doses, one in Autumn, and the remaining two through the winter.

Treatments 4 and 5. All artificials to be given in the seed-bed.

Arrangement of Plots.

The experiment consists of four series of plots, each series growing one crop of the Norfolk rotation. Each series has 25 plots, in 5 blocks of 5 plots each. Each treatment is assigned to one plot in each block, chosen at random ; and each block has one treated plot in each year, chosen initially at random ; finally each treatment is applied once in each year to one plot in each series.

Hence treatments are assigned as to five Randomised blocks of five plots each in each series, but a Latin Square scheme determines the year of application of the treatment in each series.

The plots are approximately 1/40th acre in area (.02436 acre in series A, B and C, but .023347 acre in series D).

First Series (Plots 1-25).—Years of Application.

Treatments :	Blocks. A	B	C	D	E	
1	III	V	I	II	IV	(I, II, III, IV, V = the successive years of the cycle.)
2	I	III	IV	V	II	
3	V	I	II	IV	III	
4	II	IV	III	I	V	
5	IV	II	V	III	I	

(Hence treatment 1 is applied to the appropriate plot in block C in the first year of the experiment ; to that in block D in the second year ; A in the third, and so forth.)

Second Series (Plots 26-50).—Years of Application.

Treatments :	Blocks. A	B	C	D	E
1	IV	II	III	I	V
2	I	III	II	V	IV
3	II	V	IV	III	I
4	III	I	V	IV	II
5	V	IV	I	II	III

Third Series (Plots 51-75).—Years of Application.

Treatments :	Blocks. A	B	C	D	E
1	V	III	IV	I	II
2	III	IV	I	II	V
3	I	V	II	IV	III
4	IV	II	V	III	I
5	II	I	III	V	IV

Fourth Series (Plots 76-100).—Years of Application.

Treatments :	Blocks. A	B	C	D	E
1	IV	II	I	V	III
2	I	IV	III	II	V
3	V	I	II	III	IV
4	II	III	V	IV	I
5	III	V	IV	I	II

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SIX COURSE ROTATION EXPERIMENT, ROTHAMSTED AND WOBURN

This experiment is designed to furnish data on the effect of varying amounts of the three standard fertilisers, nitrogen, phosphate, and potash, on the yield of six crops of a rotation in the different weather conditions of successive years.

Rotation.

The six courses of the rotation are : barley, clover hay, wheat, potatoes, forage-crop, sugar-beet. The forage-crop consists of equal parts (1 bushel per acre each) of rye, beans and vetches. It is sown in autumn, cut green and followed by a catch crop of mustard. The mustard is ploughed in in early autumn, and followed by rye to be ploughed in before sowing sugar-beet. After wheat, rye is sown and ploughed in in spring before planting potatoes.

The variety of barley used is Plumage-Archer, and of wheat Yeoman II.

Arrangement.

There are six areas, called " series," in Long Hoos IV, which are cropped in this rotation so that each crop is represented every year. There are fifteen plots of 1/40th acre in each series, each of which receives a different treatment. Thus there is no replication of a given crop with a given treatment in any one year. Plots do not receive the same treatments throughout, but on each plot the fifteen treatments follow one another in a definite order in successive years, and in this way cumulative effects of a treatment are avoided.

Treatments.

The fifteen treatments are :

Nitrogen set. 4, 3, 2, 1, 0 units of N, each with 2 units P and 2 units K.
Phosphate set. 4, 3, 2, 1, 0 units of P, each with 2 units K and 2 units N.
Potash set. 4, 3, 2, 1, 0 units of K, each with 2 units N and 2 units P.
1 unit of N = 0.15 cwt. of N per acre.
1 unit of P = 0.15 cwt. of P_2O_5 per acre.
1 unit of K = 0.25 cwt. of K_2O per acre.

The fertilisers used are Sulphate of Ammonia, Superphosphate and Muriate of Potash. The amount of Superphosphate applied is calculated on the basis of total P_2O_5 content.

The potassic and phosphatic fertilisers are applied to the autumn sown crops, wheat and forage-mixture, and to the clover, sown under barley in the previous spring, in the Autumn, and the nitrogenous fertiliser is given as a spring top dressing. The spring sown crops receive all their fertilisers at the time of sowing.

Within each of the three sets of treatments, the treatments 4, 3, 2, 1, 0 units follow each other in that order in successive years.

On series 2, 4, 6 the order of the sets of treatments is N, P, K, and on series 1, 3, 5, the order is N, K, P, *i.e.*, on plots of series, 2, 4, 6 treatment ON is followed by treatment 4P, OP by 4K and OK by 4N, while on series 1, 3, 5, ON is followed by 4K, OK by 4P, and OP by 4N.

Continuance of the Experiment.

After 30 years on the same land, each plot has completed 5 rotations by crops, and 2 by treatments. If continued for a further period, it will be necessary to omit one stage of the crop rotation on each series, without breaking the sequence of manurings. After two such breaks the experiment could be continued until every crop with every treatment had occurred on each plot.

Estimate of Error.

Although there is no actual replication, an estimate of error can be made from the deviations of the Yield/Quantity of fertiliser curve, from a smooth form.

In 1929-30 the six crops of the rotation were scattered in various fields of the farm, so that the experiment proper started on its permanent site in Long Hoos IV in season 1930-31.

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Four-Course Rotation, Great Hoos Field, Rothamsted, 1931 (Second Preliminary Year).

For full particulars of experiment see p. 129.

Plots $\frac{1}{40}$ acre.

TREATMENTS:

1. Farmyard manure.
2. Artificial farmyard manure prepared by Adco process. } 50 cwt. organic matter per acre.
3. Straw equivalent to that used in (2) treated on land with artifical fertilisers.
4. Superphosphate (1.2 cwt. total P_2O_5 per acre) Muriate of Potash (3 cwt. K_2O per acre) Sulphate of Ammonia (altogether 1.8 cwt. N per acre). One-fifth only applied in 1931.
5. As (4) but equivalent Gafsa Phosphate instead of Superphosphate. Nutrient content of (1), (2) and (3) equalised by adding Sulphate of Ammonia, Muriate of Potash and Superphosphate to raise the applications to the level given in (4) and (5).

Plots treated in 1931 shown in bold type.

MANURES APPLIED.

Season 1929-30.

Treatment.	Organic Fertilisers.	Artificial Fertilisers.		
	Organic Matter (cwt. per acre).	N. cwt. per acre as Sulphate of Amm.	K_2O cwt. per acre as Mur. of Potash.	P_2O_5 cwt. per acre as Superphosphate (except in T'mt. 5).
1 ..	50 (as F.Y.M.)	0.067	0.168	0.552
2 ..	50 (as Adco)	0.930	2.322	0.741
3 ..	84.58 (as Straw)	1.413	2.355	1.082
4 ..	None	0.36	0.6	1.2
5 ..	None	0.36	0.6	1.2 (as Gafsa rock phos.)

Season 1930-31.

Treatment.	Organic Fertilisers.	Artificial Fertilisers.		
	Organic Matter (cwt. per acre).	N. cwt. per acre as Sulphate of Amm.	K_2O cwt. per acre as Mur. of Potash.	P_2O_5 cwt. per acre as Superphosphate (except in T'mt. 5).
1 ..	50 (as F.Y.M.)	0.317	1.663	0.741
2 ..	50 (as Adco)	0.519	2.530	0.179
3 ..	134.22 (as Straw)	1.358	1.517	1.071
4 ..	None	0.36	0.6	1.2
5 ..	None	0.36	0.6	1.2 (as Gafsa rock phos.)

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A W—Wheat (Plots 1-25) (Harvested by sampling method).

Seed sown: Oct. 30th, 1930. Harvested: Aug. 27th. Variety: Yeoman.

Yield of Grain in cwt. per acre.

N.W.

BLOCKS						
a	5 14.4	2 16.2	1 14.2	3 11.2	4 **20.3**	5
b	5 **19.1**	1 12.4	3 11.0	4 10.3	2 12.5	10
c	3 **21.4**	2 10.6	5 10.5	4 9.7	1 11.2	15
d	1 **22.0**	3 11.4	4 20.2	5 6.4	2 6.3	20
e	4 14.4	1 10.8	5 15.5	3 9.2	2 **19.8**	25

Yield of straw in cwt. per acre.

1	5 31.9	2 30.2	1 24.4	3 21.8	4 **37.2**	5
6	5 **36.6**	1 22.4	3 20.5	4 21.4	2 25.5	10
11	3 **45.0**	2 19.3	5 19.2	4 21.0	1 23.6	15
16	1 **44.3**	3 21.3	4 42.0	5 16.4	2 14.5	20
21	4 28.3	1 20.1	5 30.0	3 17.6	2 **45.0**	25

A G—Swedes. (Plots 26-50.)

Seed sown: May 20th. Lifted: Nov. 6-17th. Variety: Garton's Magnificant.

Washed Roots—tons per acre.

N.W.

BLOCKS						
a	26 3 **12.74**	2 8.40	5 5.91	4 6.70	1 5.69	30
b	31 4 10.01	2 4.54	1 **13.00**	5 5.99	3 5.73	35
c	36 1 7.22	4 6.03	3 6.86	5 11.28	2 **13.23**	40
d	41 4 7.85	5 **10.74**	3 8.11	2 8.04	1 11.72	45
e	46 2 7.36	4 **10.31**	3 8.73	1 7.02	5 8.71	50

Tops—tons per acre.

26	3 **1.46**	2 1.19	5 1.20	4 1.29	1 1.49	30
31	4 1.17	2 0.78	1 **1.46**	5 1.14	3 1.57	35
36	1 1.01	4 0.90	3 0.93	5 1.75	2 **2.50**	40
41	4 1.05	5 **1.11**	3 0.96	2 1.32	1 2.02	45
46	2 1.02	4 **1.03**	3 1.08	1 1.25	5 1.64	50

A H—Seeds Hay. (Plots 51-75).

Seed sown: April 22nd. Cut: June 24th.

Yield of Dry Matter in cwt. per acre.

N.W.

BLOCKS						
a	51 3 33.0	4 33.0	1 31.9	2 31.2	5 **36.6**	55
b	56 3 34.4	4 **43.6**	5 40.3	2 29.3	1 30.4	60
c	61 2 35.2	4 43.6	3 **58.6**	1 30.8	5 34.8	65
d	66 5 38.1	1 46.5	3 33.7	4 32.6	2 **43.2**	70
e	71 4 43.6	2 37.4	1 **46.9**	5 40.0	3 35.2	75

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A B—Barley. (Plots 76-100.) (Harvested by sampling method.)

Seed sown: March 6th. Harvested: August 27th. Variety: Plumage Archer.

Yield of Grain in cwt. per acre.

BLOCKS

a 76	4 **26.5**	2 20.9	5 14.0	3 12.8	1 12.0	80
b 81	5 14.5	2 14.1	1 **25.9**	4 11.4	3 26.3	85
c 86	2 16.4	1 18.9	5 15.5	4 11.3	3 **22.1**	90
d 91	2 **23.1**	4 8.9	1 10.5	5 15.5	3 12.8	95
e 96	5 **19.8**	2 7.0	3 9.0	1 10.5	4 23.9	100

N.W. ↑

Yield of Straw in cwt. per acre.

76	4 **35.4**	2 27.0	5 18.4	3 19.0	1 17.0	0
81	5 18.9	2 18.9	1 **35.0**	4 25.2	3 36.2	85
86	2 27.2	1 27.2	5 25.5	4 21.2	3 **25.2**	90
91	2 **30.2**	4 12.8	1 17.8	5 27.1	3 23.8	95
96	5 **30.9**	2 9.7	3 16.4	1 18.2	4 35.8	100

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Six-Course Rotation, Long Hoos IV., Rothamsted. 1931.

For full particulars of experiment see p. 131.

Plots 1/40th acre.

TREATMENTS :

N—4, 3, 2, 1 and O units of N, each with 2 units P_2O_5 and 2 units K_2O.
K—4, 3, 2, 1 and O units of K_2O, each with 2 units N and 2 units P_2O_5.
P—4, 3, 2, 1 and O units of P_2O_5, each with 2 units N and 2 units K_2O.

1 unit of N—0.15 cwt. N per acre as Sulphate of Ammonia.
1 unit of K—0.25 cwt. K_2O per acre as Muriate of Potash.
1 unit of P—0.15 cwt. P_2O_5 per acre as Superphosphate.

BW—Wheat—(Plots 1-15) (Harvested by sampling method).

Manures applied : Oct. 29-30th, 1930. Seed sown : Oct. 3rd, 1930. Harvested - Aug. 21st. Variety : Yeoman II.

Yield of Grain in cwt. per acre.

N. ↑

3P 23.8	0P 22.7	0N 14.2	4K 18.3	2K 20.6
4N 23.8	2P 21.8	3N 19.5	0K 17.5	1K 17.9
1P 18.5	2N 19.8	1N 14.0	3K 19.3	4P 16.4

Yield of Straw in cwt. per acre.

3P 43.2	0P 42.8	0N 27.7	4K 36.7	2K 44.1
4N 51.0	2P 40.9	3N 42.7	0K 36.8	1K 38.4
1P 38.2	2N 42.2	1N 28.1	3K 41.9	4P 35.0

BS—Sugar Beet—(Plots 16-30)

Manures applied : May 9th. Seed sown : May 9th. Lifted : Nov. 3-6th. Variety : Kuhn.

Washed Roots—tons per acre.

N. ↑

3N 6.04	4P 6.32	2P 6.99	3P 7.40	3K 7.33
0N 5.88	2N 6.54	1P 6.39	0K 6.89	4N 7.81
1N 5.53	0P 6.40	4K 7.34	2K 7.11	1K 7.16

Tops—tons per acre.

3N 8.65	4P 7.80	2P 9.67	3P 10.23	3K 9.07
0N 8.04	2N 8.24	1P 9.54	0K 9.99	4N 11.33
1N 9.33	0P 10.70	4K 10.28	2K 10.40	1K 9.56

Sugar Percentage in Roots

3N 17.76	4P 17.81	2P 18.11	3P 17.88	3K 17.87
0N 17.65	2N 17.99	1P 17.54	0K 17.99	4N 17.48
1N 17.82	0P 17.99	4K 17.87	2K 18.24	1K 18.14

BB—Barley—(Plots 31-45) (Harvested by sampling method)

Manures applied : Feb. 27th. Seed Sown : March 6th. Harvested : Aug. 29th. Variety : Plumage Archer.

Yield of Grain in cwt. per acre.

N. ↑

2K 22.2	0K 19.2	0P 19.2	2P 22.6	3N 20.4
3K 20.0	1K 25.2	4N 21.4	4K 20.9	0N 13.2
4P 19.4	3P 19.6	1P 18.9	2N 20.6	1N 18.9

Yield of Straw in cwt. per acre.

2K 27.4	0K 23.7	0P 23.4	2P 23.6	3N 23.8
3K 27.7	1K 30.4	4N 31.9	4K 30.4	0N 18.3
4P 23.0	3P 26.7	1P 24.9	2N 27.5	1N 22.2

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B C—Clover—(Plots 46-60).

Manures applied: Oct. 31st, 1930. Seed sown: April 22nd. Cut: June 10th.

Yield of Dry Matter in cwt. per acre.

N.

3P 12.9	0P 12.9	1K 11.8	4N 15.0	2N 13.2
1P 18.9	4K 20.0	2K 18.2	3N 16.1	1N 10.0
2P 23.2	0K 18.9	3K 17.5	0N 13.6	4P 18.2

B P—Potatoes—(Plots 61-75)

Manures applied: April 14th. Planted: April 14th. Lifted: Oct. 1st. Variety: Ally.

Yield of Roots in tons per acre.

N.

4P 8.04	0K 4.33	1P 7.46	0P 6.52	1N 7.63
3K 8.82	1K 7.16	2P 8.73	0N 7.83	4K 10.28
2K 7.79	3P 8.45	4N 8.40	2N 8.14	3N 7.67

B F—Forage Crop—(Plots 76-90).

Manures applied: March 18th. Seed sown: Oct 3rd, 1930. Harvested: June 10th (followed by mustard).

Yield of Dry Matter in cwt. per acre.

N.

4K 29.3	0P 29.3	3K 29.3	0K 28.2	0N 22.5
2P 30.7	3P 31.8	4N 43.9	2N 32.9	3N 38.9
1P 40.4	2K 33.6	1K 32.1	4P 30.4	1N 27.1

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SUMMARY OF RESULTS.

1.—Table showing increments in yield per cwt. of N, P_2O_5 and K_2O, together with the standard errors of the increments.

Crop.	Mean Yield.	N		P		K	
Wheat—Grain, cwt. ..	19.2	**16.4**	± 4.8	—4.9	± 4.8	1.2	± 2.8
Straw, cwt.	39.3	**41.0**	± 7.5	—7.1	± 7.5	1.3	± 4.5
Sugar Beet—Roots, tons ..	6.74	**2.91**	± 1.02	0.57	± 1.02	0.43	± 0.61
Tops, tons ..	9.52	3.94	± 1.87	—3.41	± 1.87	0.04	± 1.12
Sugar Per Centage	17.88	—0.27	± 0.44	—0.01	± 0.44	—0.20	± 0.26
Barley—Grain, cwt. ..	20.1	**11.8**	± 4.6	0.7	± 4.6	—0.6	± 2.7
Straw, cwt. ..	25.6	**19.2**	± 5.1	0.7	± 5.1	4.3	± 3.1
Clover—dry matter, cwt.	15.7	5.7	± 6.2	2.1	± 6.2	2.3	± 3.7
Potatoes—tons	7.82	0.79	± 1.21	2.70	± 1.21	**5.42**	± 0.72
Forage—dry matter, cwt.	32.0	**29.9**	± 9.0	2.7	± 9.0	—6.1	± 5.4

2.—Table showing the average percentage increments in yield for each application of N, P_2O_5 and K_2O, with their standard errors.

Crop.	N	P	K	Standard Error.
Wheat—Grain ..	**12.83**	—3.85	1.56	± 3.73
Straw ..	**15.58**	—2.72	0.80	± 2.87
Sugar Beet—Roots	**6.48**	1.26	1.59	± 2.27
Tops	6.20	—5.36	0.09	± 2.94
Sugar Percentage	—0.22	—0.01	—0.28	± 0.37
Barley—Grain ..	**8.88**	0.55	—0.78	± 3.41
Straw ..	**11.23**	0.37	4.22	± 2.98
Clover—dry matter ..	5.41	1.97	3.63	± 5.92
Potatoes	1.51	5.15	**17.34**	± 2.31
Forage—dry matter ..	**14.04**	1.25	—4.76	± 4.22

Significant results are in bold type. Negative sign means depression.

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Six-Course Rotation; Stackyard Field, Woburn, 1931

For full particulars of experiment see p. 131, Rothamsted Report.

PLOTS: 1/40th acre.
TREATMENTS:
N=4, 3, 2, 1 and 0 units of N, each with 2 units P_2O_5 and 2 units K_2O.
K=4, 3, 2, 1 and 0 units of K_2O, each with 2 units N and 2 units P_2O_5.
P=4, 3, 2, 1 and 0 units of P_2O_5, each with 2 units N and 2 units K_2O.
1 unit of N=0.15 cwt. N per acre as Sulphate of Ammonia.
1 unit of K=0.25 cwt. K_2O per acre as Muriate of Potash.
1 unit of P=0.15 cwt. P_2O_5 per acre as Superphosphate.

C P—Potatoes (Plots 1-15).

Manures applied: April 30th. Planted: May 1st. Lifted: Sept. 29-30th. Variety: Ally.

Yield of Roots in tons per acre.

2N 11.07	4K 11.39	3K 11.46	2K 11.57	3P 11.30
3N 12.66	0N 9.45	0K 11.18	0P 10.18	2P 11.91
1N 8.28	4P 9.91	1K 10.20	1P 9.68	4N 10.64

C F—Forage Crop (Plots 16-30)

Manures applied: April 4th. Seed sown: October 18th. Harvested: June 15th (followed by mustard).

Yield of Hay containing 15 per cent. water, in cwt. per acre.

2K 49.3	0K 52.9	4P 55.7	3N 52.3	2P 43.3
1K 47.7	4N 51.6	1N 41.3	0P 48.4	4K 53.4
3K 47.0	2N 45.4	0N 32.9	3P 54.8	1P 47.0

C W—Wheat (Plots 31-45)

Manures applied: April 4th. Seed sown: Oct. 18th. Harvested: Aug. 11-20th. Variety: Yeoman II.

Yield of Grain in cwt. per acre.

3N 10.2	4K 9.2	3K 10.9	1K 13.5	1P 14.2
0N 5.0	2N 9.3	0K 10.7	0P 11.3	2P 14.1
1N 9.7	2K 10.4	4P 10.4	4N 17.1	3P 12.6

Yield of Straw in cwt. per acre.

3N 26.2	4K 22.2	3K 25.2	1K 29.6	1P 30.0
0N 13.3	2N 25.0	0K 29.9	0P 27.6	2P 32.6
1N 21.9	2K 25.7	4P 27.9	4N 38.4	3P 32.4

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C B—Barley (Plots 46-60).

Manures applied : March 17th. Seed sown : March 18th. Harvested : Aug. 21st. Variety : Plumage Archer.

Yield of Grain in cwt. per acre.

1N 19.8	0N 17.0	3P 25.8	0P 20.9	0K 18.4
2N 25.3	3N 25.3	1P 26.4	3K 23.9	4N 29.3
4P 24.8	2P 24.3	4K 26.1	1K 29.1	2K 27.7

Yield of Straw in cwt. per acre.

1N 41.6	0N 51.6	3P 49.3	0P 52.7	0K 52.9
2N 41.8	3N 43.0	1P 50.2	3K 68.7	4N 72.2
4P 48.8	2P 51.4	4K 53.7	1K 53.7	2K 55.4

C S—Sugar Beet (Plots 61-75).

Manures applied : May 6th. Seed sown : May 7th. Lifted : Oct. 29-31st. Variety : Kuhn.

Washed Roots—tons per acre.

1K 4.93	0K 5.70	2P 6.92	4N 7.73	3N 7.54
4P 7.38	2K 6.70	0P 6.68	1N 6.61	0N 6.22
3K 7.18	3P 7.32	1P 6.94	4K 6.97	2N 5.86

Tops—tons per acre.

1K 4.28	0K 4.36	2P 6.62	4N 10.21	3N 8.50
4P 6.94	2K 6.55	0P 7.78	1N 8.61	0N 8.63
3K 8.61	3P 7.64	1P 7.20	4K 10.25	2N 8.66

Sugar Percentage in Roots.

1K 16.86	0K 16.58	2P 17.08	4N 16.90	3N 16.31
4P 17.37	2K 17.42	0P 17.76	1N 17.28	0N 17.19
3K 17.54	3P 17.40	1P 17.48	4K 17.43	2N 16.74

C C—Tares (for Clover) (Plots 76-90).

Manures applied : April 28th. Seed sown : May 28th. Cut : Sept. 9th.

Hay containing 15% Water—cwt. per acre.

0K 26.6	1K 23.8	4P 26.0	0N 24.5	1P 27.9
2K 32.0	4N 29.5	3N 29.5	0P 28.6	4K 30.8
3K 31.1	1N 29.0	2N 32.2	2P 27.8	3P 31.1

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SUMMARY OF RESULTS

1. Table showing increments in yield per cwt. of N, P_2O_5 and K_2O, together with the standard errors of the increments

Crop.	Mean Yield.	N	P	K
Potatoes—tons ..	10.72	4.52 ± 2.34	0.72 ± 2.34	0.67 ± 1.40
Forage—dry matter, cwt.	41.0	**27.6** ± 6.5	12.7 ± 6.5	0.1 ± 3.9
Wheat—Grain, cwt. ..	11.2	**16.5** ± 4.0	—2.4 ± 4.0	—2.2 ± 2.4
Straw, cwt. ..	27.2	**36.5** ± 5.2	2.1 ± 5.2	**—7.9** ± 3.1
Barley—Grain, cwt. ..	24.3	**20.0** ± 6.2	4.8 ± 6.2	4.1 ± 3.7
Straw, cwt. ..	52.5	28.5 ± 18.0	—5.7 ± 18.0	6.7 ± 10.8
Sugar Beet—Roots, tons	6.71	**2.64** ± 1.10	1.19 ± 1.10	**1.91** ± 0.66
Tops, tons* ..	8.15	3.56 ± 1.71	1.50 ± 1.71	**4.71** ± 1.02
Sugar Percentage	17.16	—1.04 ± 0.58	—0.58 ± 0.58	**0.95** ± 0.34
Tares—dry matter, cwt.	24.4	5.9 ± 4.6	—1.1 ± 4.6	5.4 ± 2.7

* Tops partially eaten by barking deer, damage visually estimated.

2. Table showing the percentage increments in yield for N, P_2O_5 and K_2O with their standard errors

Crop.	N	P	K	Standard Error.
Potatoes	6.30	1.01	1.57	± 3.26
Forage—dry matter	**10.03**	4.65	0.06	± 2.38
Wheat—Grain ..	**22.01**	—3.18	—4.99	± 5.29
Straw ..	**20.02**	1.15	**—7.28**	± 2.87
Barley—Grain ..	**12.32**	2.98	4.19	± 3.84
Straw ..	8.13	—1.64	3.20	± 5.13
Sugar Beet—Roots	**5.88**	2.65	**7.14**	± 2.46
Tops	6.51	2.75	**14.45**	± 3.13
Sugar Percentage	—0.90	—0.50	**1.39**	± 0.50
Tares—dry matter	3.68	—0.70	5.48	± 2.79

Significant results are in bold type. Negative sign means depression.

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REPLICATED EXPERIMENTS AT ROTHAMSTED

HAY

Temporary Ley Experiment: Preparation for Wheat in 1932.

R H—Long Hoos (Section 5) 1931.

N.E.

I.	CR(2)	CR(1)	C (2)	C (1)
II.	C (1)	CR(2)	CR(1)	C (2)
III.	CR(1)	C (2)	C (1)	CR(2)
IV.	C (2)	C (1)	CR(2)	CR(1)

System of Replication: 4×4 Latin Square.
Area of Each Plot: .121 acre.
Treatments:
C=Clover.
CR=Clover and Ryegrass.
First crop cut: July 1st-2nd. On plots marked (2), a second crop was cut on Aug. 27th.
Previous crop: Barley.

Actual Green weights in lb.

Row	First Crop.				Second Crop.	
	C (1)	C (2)	CR (1)	CR (2)	C (2)	CR (2)
I	2059	2171	1899	1696	316	442
II	1534	1856	1922	1824	271	422
III	2072	2219	1417	1921	265	401
IV	2188	1310	1981	1793	436	395

Summary of Results—Dry Matter.

Average yield.	Clover.	Clover and Ryegrass.	Mean.	Standard Error.
First Crop.				
Cwt. per acre ..	39.8	37.3	38.6	1.08
Per cent. ..	103.2	96.8	100.0	2.80
Second Crop.				
Cwt. per acre ..	12.5	16.1	14.3	—
Per cent. ..	87.3	112.7	100.0	—

The difference between the mixtures is not significant for either crop.

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BARLEY

Undersowings for temporary ley of clover and ryegrass. Nitrogenous Fertiliser. Sulphate of Ammonia.

R B—Fosters, 1931.

N.E.

I.	R	—	—	O	—	C	CR	—
II.	—	O	R	—	CR	—	C	—
III.	—	CR	—	C	R	—	O	—
IV.	C	—	CR	—	O	—	—	R

SYSTEM OF REPLICATION: 4 × 4 Latin Square, with split plots
AREA OF EACH SUB-PLOT: .05355 acre.
VARIETY: Plumage Archer undersown with Italian Rye Grass (R) and Broad Red Clover (C).
TREATMENTS: Sulphate of Ammonia at the rate of 0.2 cwt. N per acre, applied to one out of each pair of sub-plots (indicated by the treatment symbol occurring on that half).
Manures applied: March 23rd.
Seed sown: Barley, March 23rd; Rye Grass and Clover, April 23rd.
Barley Harvested: August 27th.
Previous crop: Temporary Ley.

Actual weights in lb.—Grain.

Row.	Without Sulphate of Ammonia.				With Sulphate of Ammonia.			
	O	C	R	CR	O	C	R	CR
I. ..	106.50	70.50	108.00	68.75	95.25	98.25	90.00	97.25
II. ..	112.25	82.00	100.50	76.25	112.50	99.50	120.50	61.75
III. ..	81.00	111.75	77.75	134.00	87.00	117.50	83.25	130.25
IV. ..	80.00	119.00	86.00	91.00	97.25	131.50	93.00	110.75

Actual weights in lb.—Straw.

Row.	Without Sulphate of Ammonia.				With Sulphate of Ammonia.			
	O	C	R	CR	O	C	R	CR
I. ..	145.00	106.50	147.25	94.75	128.75	119.25	164.25	122.75
II. ..	151.50	105.00	128.00	114.75	164.00	117.50	163.00	155.75
III. ..	86.00	156.75	88.25	165.00	129.50	166.00	119.25	179.75
IV. ..	98.25	152.75	109.25	122.50	130.75	159.50	116.25	159.00

Summary of Results.

Average Yield	Cwt. per acre.					Per cent.				
	No Ley	Clover	Ryegrass	Clover + Ryegrass	Mean.	No Ley	Clover	Ryegrass	Clover + Ryegrass	Mean
Grain—										
Without S./Amm.	15.8	16.0	15.5	15.4	15.7	97.0	97.9	95.1	94.5	96.2
With S./Amm.	16.3	18.6	16.1	16.7	16.9	100.2	114.2	98.8	102.2	103.8
Mean ..	16.1	17.3	15.8	16.0	16.3	98.6	106.0	97.0	98.4	100.0
Straw—										
Without S./Amm.	20.0	21.7	19.7	20.7	20.5	90.1	97.7	88.6	93.2	92.4
With S./Amm.	23.0	23.4	23.5	25.7	23.9	103.7	105.4	105.5	115.7	107.6
Mean ..	21.5	22.6	21.6	23.2	22.2	96.9	101.6	97.1	104.5	100.0

	Grain.	*Straw.*
Standard Errors: Single treatment	= 1.01 cwt. or 6.2%	1.05 cwt. or 4.7%
Mean of S./Amm. and No S./Amm.	= 0.80 cwt. or 4.9%	0.82 cwt. or 3.7%

The effect of Sulphate of Ammonia on the straw is definitely significant, but the difference does not reach the 5% level of significance for grain. There are no other significant effects.

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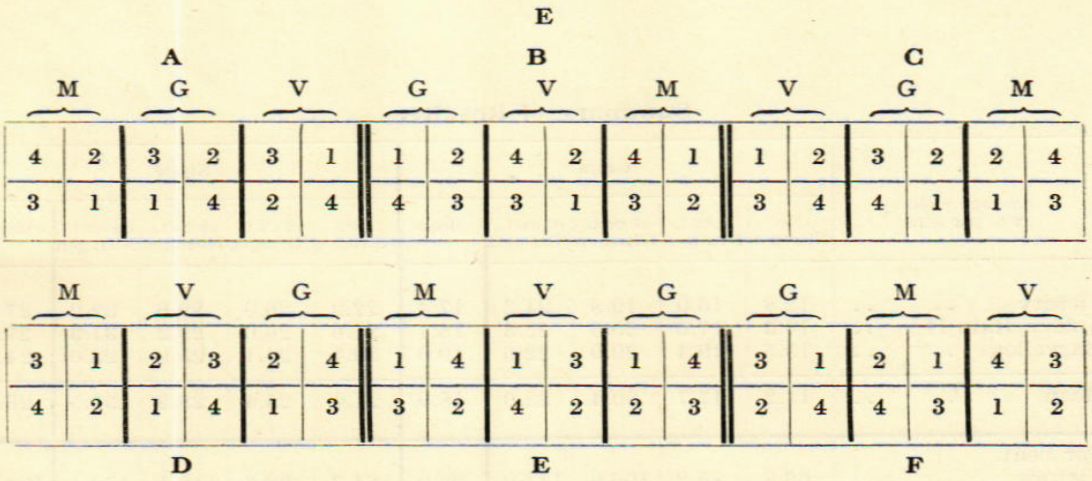
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OATS

Variety Trial.

Nitrogenous Fertiliser: Sulphate of Ammonia at four levels.

R O—Gt. Harpenden, 1931



System of Replication: 6 randomised blocks of 3 plots, each sub-divided into 4.
Area of Each Plot: 1/80th acre.
Treatments (sub plots):
1=No Nitrogen.
2=S/Amm. at the rate of 0.2 cwt. N per acre.
3=S/Amm. at the rate of 0.4 cwt. N per acre.
4=S/Amm. at the rate of 0.6 cwt. N per acre.
Manures applied: Feb. 25-26th.

Varieties (main plots): V=Victory.
G=Golden Rain II.
M=Marvellous.
Seed sown: February 25th.
Oats Harvested: August 18-20th.
Previous crop: Temporary Ley: 1st crop taken for hay, aftermath eaten off by sheep given turnips and corn.

Actual weights in lb.—Grain.

Block.	M				G				V			
	1	2	3	4	1	2	3	4	1	2	3	4
A	15.75	17.50	27.25	24.75	20.00	20.50	23.50	31.50	15.50	22.50	25.00	29.00
B	22.25	32.25	33.00	31.00	15.00	25.50	22.25	24.00	17.00	16.00	28.00	21.50
C	24.25	24.75	29.75	30.25	22.25	20.50	21.50	26.00	13.25	18.50	29.50	28.25
D	26.25	35.00	29.50	39.00	29.25	28.50	40.25	35.25	27.75	32.50	39.25	43.50
E	17.50	22.25	26.00	29.25	16.00	25.75	33.00	33.25	18.50	22.25	20.25	30.50
F	24.00	31.00	30.25	36.00	17.50	27.00	31.50	37.25	15.25	22.75	24.25	25.00

Actual weights in lb.—Straw.

Block.	M				G				V			
	1	2	3	4	1	2	3	4	1	2	3	4
A	23.50	28.00	38.50	35.25	28.00	30.75	40.75	42.00	31.50	32.00	37.50	41.25
B	32.75	39.75	38.00	42.50	25.00	37.75	38.50	39.75	36.50	34.50	43.75	38.25
C	34.50	35.75	41.50	40.75	40.50	36.00	43.00	41.75	26.50	37.50	41.00	45.25
D	28.50	36.75	35.00	44.25	28.75	35.00	40.50	43.50	31.75	47.25	42.50	44.75
E	21.50	27.75	31.00	33.50	32.00	34.75	43.00	47.25	30.00	31.75	38.50	49.75
F	30.50	34.75	33.25	39.25	27.25	44.00	39.50	48.75	30.50	35.50	45.25	51.25

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Summary of Results.

Average yield cwt. per acre	Grain					Straw				
	No Nitrogen	.2 cwt. Nitrogen	.4 cwt. Nitrogen	.6 cwt. Nitrogen	Mean	No. Nitrogen	.2 cwt. Nitrogen	.4 cwt. Nitrogen	.6 cwt. Nitrogen	Mean
Victory	12.8	16.0	19.8	21.2	17.4	22.2	26.0	29.6	32.2	27.5
Golden Rain II ..	14.3	17.6	20.5	22.3	18.7	21.6	26.0	29.2	31.3	27.0
Marvellous	15.5	19.4	20.9	22.6	19.6	20.4	24.1	25.9	28.0	24.6
Mean	14.2	17.7	20.4	22.0	18.6	21.4	25.4	28.2	30.5	26.4
Per cent.										
Victory	68.8	86.2	106.6	114.0	93.9	84.3	98.6	112.1	122.1	104.3
Golden Rain II ..	76.9	94.7	110.3	120.1	100.5	81.9	98.5	110.7	118.7	102.4
Marvellous	83.4	104.4	112.7	122.0	105.6	77.3	91.5	98.0	106.3	93.3
Mean	76.4	95.1	109.9	118.7	100.0	81.2	96.2	107.0	115.7	100.0

Standard Errors.

	cwt. per acre.			per cent.		
	Single treatment.	Mean of 3 varieties.	Mean of 4 treatments	Single treatment.	Mean of 3 varieties.	Mean of 4 treatments.
Grain ..	1.23	0.56	0.89	6.6	3.0	4.8
Straw ..	1.22	0.62	0.78	4.6	2.4	3.0

The response to nitrogen is definitely significant, but the experiment is not sufficiently precise to show any difference between the varieties, either in differential response or in average yield.

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WHEAT.

Comparison of Sulphate and Muriate of Ammonia in early and late top dressings.

R W—Little Hoos, 1931.

	A			E	B			
	S.E.	M.E.L.	S.E.L.	O(1)	S.L.	S.E.L.	M.E.	O(1)
	M.E.	O(2)	S.L.	M.L.	M.E.L.	M.L.	S.E.	O(2)
C	M.E.L.	M.L.	S.E.	M.E.	M.E.	O(1)	S.E.	S.E.L.
	S.E.L.	S.L.	O(1)	O(2)	S.L.	M.E.L.	O(2)	M.L.
	M.E.L.	O(1)	O(2)	S.E.L.	O(1)	M.E.	S.E.	S.L.
	M.L.	M.E.	S.L.	S.E.	S.E.L.	M.L.	M.E.L.	O(2)
		E				F		D

System of Replication: 6 randomised blocks of 8 plots each.

Area of Each Plot: 1/60th acre.

Treatments: Sulphate or Muriate of Ammonia applied early or late, or neither or both, making 8 combinations, of which two (without either dressing) are identical.

Basal manure: 13-16 tons farmyard manure per acre.

Early manures applied: March 20th.

Late manures applied: May 1st.

Wheat sown: October 10th.

Wheat harvested: August 22nd.

Variety: Million.

Previous crop: Oats.

Actual weights in lb.—Grain.

Block	O(1)	O(2)	S.E.	M.E.	S.L.	M.L.	S.E.L.	M.E.L.
A	35.00	38.25	40.00	47.00	39.75	42.25	37.50	36.50
B	43.75	41.75	43.50	41.75	41.00	46.50	41.50	44.75
C	38.50	36.25	38.00	41.00	37.75	41.25	43.75	44.00
D	45.75	38.25	42.00	45.00	38.00	38.50	40.25	48.25
E	37.00	39.50	34.00	34.25	29.50	37.00	38.50	39.00
F	35.50	32.50	37.50	41.25	33.50	37.00	38.00	38.75

Actual weights in lb.—Straw.

Block	O(1)	O(2)	S.E.	M.E.	S.L.	M.L.	S.E.L.	M.E.L.
A	70.25	70.50	76.50	81.25	81.75	89.75	91.50	88.00
B	71.00	68.75	88.50	88.25	86.00	90.50	99.50	99.50
C	71.25	73.00	77.75	93.50	82.75	82.25	90.25	98.50
D	86.75	62.00	82.50	99.75	81.50	68.75	100.75	96.75
E	72.00	75.00	73.50	79.75	71.50	79.25	96.00	98.75
F	81.00	60.50	76.75	92.00	84.75	73.75	90.00	78.50

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Summary of Results.

Average Yield.	No Nitrogen.	Sulphate Early.	Sulphate Late.	Muriate Early.	Muriate Late.	Sulphate Early and Late.	Muriate Early and Late.	Mean.	Standard Errors.
Grain—									
cwt. per acre	20.6	21.0	19.6	22.3	21.6	21.4	22.4	21.2	0.624
per cent.	97.3	98.9	92.4	105.4	102.1	100.8	105.8	100.0	2.94
Straw—									
cwt. per acre	38.5	42.5	43.6	47.7	43.2	50.7	50.0	44.3	1.496
per cent.	86.8	95.8	98.3	107.6	97.5	114.4	112.8	100.0	3.37

Mean of Sulphate and Muriate.

Average yield.	Grain.			Straw		
	Not applied early.	Applied early.	Mean.	Not applied early.	Applied early.	Mean.
cwt. per acre.						
Not applied late ..	20.6	21.7	21.1	38.5	45.1	41.8
Applied late	20.6	21.9	21.3	43.4	50.4	46.9
Mean	20.6	21.8	21.2	40.9	47.7	44.3
per cent.						
Not applied late ..	97.3	102.2	99.7	86.8	101.7	94.2
Applied late	97.3	103.3	100.3	97.9	113.6	105.8
Mean	97.3	102.7	100.0	92.4	107.6	100.0

Standard Errors: Grain—Single Treatment 0.44 cwt. or 2.08%. Straw—1.06 cwt. or 2.39%.
Mean of 2 Treatments 0.31 cwt. or 1.47%. 0.75 cwt. or 1.69%.

Taking the average of sulphate and muriate, both grain and straw are increased significantly by the early application, but only straw by the late application. The plots receiving muriate have given higher yields than those receiving sulphate in both grain and straw, the difference in grain being decidedly significant.

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Wheat: Comparison of Sulphate of Ammonia and Cyanamide in small repeated top dressings and two spring top dressings.

R W—Long Hoos (Section 4) 1931

NE

I.	S.C.	O.	S.S.	R.S.	R.C.
II.	R.S.	R.C.	O.	S.S.	S.C.
III.	S.S.	R.S.	S.C.	R.C.	O.
IV.	R.C.	S.C.	R.S.	O.	S.S.
V.	O.	S.S.	R.C.	S.C.	R.S.

System of Replication: 5 × 5 Latin Square.
Area of Each Plot: 1/100th acre.
Variety: Yeoman.
Treatments: Repeated Sulphate of Ammonia (RS) *v* Cyanamide (RC) each in 8 applications at end of October, November, December, January, February, March, April, May. Spring Sulphate of Ammonia (SS) *v* Cyanamide (SC) in 2 applications, March 20th and May 1st. The fifth treatment consists of no top dressing. Quantity Sulphate of Ammonia and Cyanamide at the rate of 0.4 cwt. N per acre.
Seed sown: Oct. 3.
Harvested: Aug. 21st.
Previous crop: Temporary Ley.

Actual weights in grammes.

Row.	Grain.					Straw.				
	O.	R.S.	R.C.	S.S.	S.C.	O.	R.S.	R.C.	S.S.	S.C.
I.	360	479	357	446	482	678	986	739	910	982
II.	340	488	375	408	524	676	868	776	839	980
III.	319	507	308	441	396	612	982	597	842	720
IV.	356	399	390	422	520	710	815	781	847	976
V.	416	449	378	452	430	755	851	763	875	860

Summary of Results.

Average yield.	No Nitrogen.	Repeated S/Amm.	Repeated Cyanamide	Spring S/Amm.	Spring Cyanamide	Mean.	Standard Error.
Grain—							
cwt. per acre	15.6	20.2	15.7	18.9	20.5	18.2	0.688
per cent.	85.8	111.2	86.6	103.8	112.6	100.0	3.73
Straw							
cwt.per acre	29.9	39.2	31.8	37.6	39.4	35.6	1.39
per cent.	84.0	110.2	89.5	105.6	110.6	100.0	3.91

For the two types of nitrogen taken together, spring dressings are significantly superior to repeated dressings. For the two methods of application taken together sulphate of ammonia is superior to cyanamide. Repetition treatment is strikingly unfavourable in the case of cyanamide.

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Wheat Cultivation Experiment

R W—Little Hoos, 1931

E

A				B							
S		P		O		O		S		P	
H	N	N	HR	N	R	N	R	H	N	N	R
HR	R	R	H	H	HR	HR	H	HR	R	H	HR
O		S		P		S		O		P	
HR	R	HR	H	HR	H	R	N	HR	H	N	HR
N	H	R	N	R	N	H	HR	N	R	R	H
C						D					

SYSTEM OF REPLICATION : 4 randomised blocks of 3 plots, each plot sub-divided into 4.
AREA OF EACH SUB-PLOT : 1/60th acre.
CULTIVATIONS (main plots) :
O=Ordinary plough.
S=Simar.
P=Pulverator plough.

CULTIVATIONS (sub-plots) :
H=Harrowed.
R=Rolled.
HR=Harrowed and Rolled.
N=Neither Harrowed nor Rolled.
Basal Manure : 13-16 tons farmyard manure per acre.
Variety : Million.
Seed sown : October 10th.
Harvested : August 24th.
Previous crop : Winter oats.

Actual weights in lb.—Grain.

Block	S				P				O			
	H	R	N	HR	H	R	N	HR	H	R	N	HR
A	23	20	16	22	30	26	20	34	29	28	22	31
B	28	28	29	28	35	32	32	38	30	30	26	32
C	28	25	27	31	36	30	32	34	32	31	29	24
D	30	32	28	34	32	32	31	34	34	30	34	32

Actual weights in lb.—Straw.

Block	S				P				O			
	H	R	N	HR	H	R	N	HR	H	R	N	HR
A	72	76	70	59	72	79	75	67	55	70	58	66
B	68	73	78	67	75	85	76	74	67	64	64	75
C	65	76	64	76	74	68	67	63	79	90	82	85
D	74	71	64	70	70	93	88	75	88	88	78	71

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Summary of Results.

Average yield.	Ordinary.	Simar.	Pulverator	Mean.	Standard Single Treatment.	Errors. Mean.
Grain—cwt. per acre.						
Neither Harrowed nor Rolled	14.9	13.4	15.4	14.6	} 0.795	0.403
Rolled only	15.9	14.1	16.1	15.4		
Mean	15.4	13.7	15.7	15.0	0.624	0.285
Harrowed only ..	16.7	14.6	17.8	16.4	} 0.795	0.403
Harrowed and Rolled ..	15.9	15.4	18.8	16.7		
Mean	16.3	15.0	18.3	16.5	0.624	0.285
General Mean	15.9	14.4	17.0	15.8	0.517	
Grain—per cent.						
Neither Harrowed nor Rolled	94.4	85.0	97.8	92.4	} 5.05	2.56
Rolled Only	101.2	89.3	102.1	97.5		
Mean	97.8	87.2	99.9	95.0	3.96	1.81
Harrowed only ..	106.3	92.7	113.1	104.0	} 5.05	2.56
Harrowed and Rolled ..	101.2	97.8	119.1	106.0		
Mean	103.8	95.2	116.1	105.0	3.96	1.81
General Mean	100.8	91.2	108.0	100.0	3.28	
Straw—cwt. per acre.						
Neither Harrowed nor Rolled	37.8	37.0	41.0	38.6	} 2.36	0.932
Rolled only	41.8	39.6	43.5	41.6		
Mean	39.8	38.3	42.2	40.1	2.06	0.659
Harrowed only	38.7	37.4	39.0	38.4	} 2.36	0.932
Harrowed and Rolled ..	39.8	36.4	37.4	37.9		
Mean	39.2	36.9	38.2	38.1	2.06	0.659
General Mean	39.5	37.6	40.2	39.1	1.90	
Straw—per cent.						
Neither Harrowed nor Rolled	96.6	94.5	104.8	98.6	} 6.03	2.38
Rolled only	106.8	101.4	111.3	106.5		
Mean	101.7	97.9	108.0	102.6	5.28	1.68
Harrowed only ..	99.0	95.5	99.6	98.0	} 6.03	2.38
Harrowed and Rolled ..	101.7	93.2	95.5	96.8		
Mean	100.3	94.3	97.6	97.4	5.28	1.68
General Mean	101.0	96.1	102.8	100.0	4.86	

For the grain pulverator cultivation is significantly superior to simar cultivation. The pulverator is not significantly superior to ordinary cultivation, and the inferiority of the simar to ordinary cultivation is barely significant. Harrowing significantly increases grain. For the straw the significant loss due to harrowing is only shown on the rolled plots.

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FORAGE CROPS

Correction to 1930 Experiment. (See p. 156.)

The conclusions drawn from this experiment stand without alteration, with the exception that the response to potash for grain and straw should have been stated to be significant on the oats mixtures as well as the barley mixtures, this response not being in fact significantly different for the two cereals. In the table showing Effect of Potash and Superphosphate (p. 144) the yields of the different mixtures are based on different numbers of plots, and are not equalised for rows and columns.

There is, also, an arithmetical error in the same table (Effect of Potash and Superphosphate). The yields for straw, barley with peas, without and with potash should read 26.2 and 28.8 respectively, instead of 20.9 and 34.1. The corresponding means of all mixtures now become 27.8 and 29.8 instead of 26.5 and 31.2.

The systematic arrangement of the strips of vetches and peas, and oats and barley, not commented on in the 1930 report, was an error in sowing. In the original design the layout consisted of *randomised* pairs of strips, after the manner of the 1929 experiment on sugar beet.

Forage Crop: Comparison of Oats and Wheat, Vetches and Peas. Basal Crop of Beans.

Effect of Sulphate of Ammonia and Nitrate of Soda.
Effect of Muriate of Potash and Superphosphate.
R F—Little Hoos, 1931.

N.E.

	O	W	W	O	O	W	O	W	W	O	W	O	
I.	4	8	6	2	10	7	5	11	1	3	12	9	V
II.	11	3	7	5	9	2	4	8	6	12	1	10	P
III.	3	7	1	12	8	10	6	4	11	5	9	2	P
IV.	7	10	4	11	6	9	2	3	5	1	8	12	V
V.	12	5	8	6	3	1	9	10	4	11	2	7	V
VI.	6	1	10	9	4	3	8	5	12	2	7	11	P
VII.	5	6	9	4	12	11	10	1	2	7	3	8	V
VIII.	1	4	5	3	7	12	11	2	8	9	10	6	P
IX.	10	11	2	7	5	8	12	9	3	4	6	1	P
X.	9	2	12	1	11	6	3	7	10	8	4	5	V
XI.	8	9	3	10	2	5	1	12	7	6	11	4	V
XII.	2	12	11	8	1	4	7	6	9	10	5	3	P

Key to Treatments.

1	2	3	4	5	6	7	8	9	10	11	12
—	—	—	—	S/A	S/A	S/A	S/A	N/S	N/S	N/S	N/S
—	K	—	K	—	K	—	K	—	K	—	K
—	—	P	P	—	—	P	P	—	—	P	P

System of Replication: 12×12 Latin Square, with randomised pairs of rows and columns allotted to different seedings.
Area of Each Plot: 1/50th acre. Half cut for hay, half harvested.
Manurial Treatments: No Nitrogen *v.* Sulphate of Ammonia (S/A) at the rate of 0.2 cwt. N per acre *v.* Nitrate of Soda (N/S) at the rate of 0.2 cwt. N per acre. Potash *v* Muriate of Potash (K) at the rate of 0.5 cwt. K_2O per acre. No Phosphate *v* Superphosphate (P) at the rate of 0.5 cwt. P_2O_5 per acre.
O=Oats at the rate of 3 bushels per acre.
W=Wheat at the rate of 2 bushels per acre.
V=Vetches at the rate of 1 bushel per acre.
P=Peas at the rate of 1 bushel per acre.
Basal Crop: Beans at the rate of 1 bushel per acre.
All plots received Adco at the rate of 14 tons (approx.) per acre (September 12th).
Manures sown: March 24th-25th.
Beans, peas and vetches sown: October 9th-10th.
Other crops: October 11th.
Peas redrilled: Mar. 25th.
Half-plots cut for hay: July 9th-14th.
Remainder harvested: August 17th-21st.
Previous crop: Winter Oats.

https://doi.org/10.23637/ERADOC-1-65 *pp 44*

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Actual weights in lb.—Hay (Dry Matter).

Row.	1	2	3	4	5	6	7	8	9	10	11	12
I.	69.9	74.8	59.3	73.3	69.6	80.5	77.0	64.9	70.6	80.8	66.4	72.1
II.	55.0	67.4	69.7	63.2	65.6	74.7	78.6	60.7	63.8	66.6	64.8	72.1
III.	70.3	56.3	67.8	58.8	58.6	64.6	58.9	66.2	58.4	64.8	69.7	63.8
IV.	66.6	55.7	51.7	47.6	53.5	68.6	65.1	58.8	63.8	68.8	65.5	68.3
V.	46.5	60.8	53.8	59.7	57.9	61.0	64.9	47.4	70.1	70.7	61.2	63.1
VI.	39.5	47.1	41.1	43.7	47.6	55.9	45.2	47.7	57.7	53.8	49.4	56.2
VII.	40.4	44.7	42.0	48.7	55.5	58.5	50.5	53.6	54.8	51.4	51.6	61.9
VIII.	54.6	43.0	54.2	44.1	56.7	58.0	58.0	50.2	54.7	58.0	56.8	53.7
IX.	54.3	46.4	37.6	42.2	51.1	52.7	56.5	53.2	57.3	64.1	55.1	57.1
X.	52.3	53.5	51.8	46.7	54.8	60.5	56.8	58.9	59.9	52.6	63.6	59.6
XI.	47.8	46.5	53.5	43.0	59.4	59.3	55.9	60.8	56.5	68.1	61.8	58.3
XII.	46.2	47.5	50.4	43.4	51.4	52.5	51.7	53.2	51.9	58.9	59.0	54.0

Actual weights in lb.—Grain and Pulse.

Row.	1	2	3	4	5	6	7	8	9	10	11	12
I.	24	20	28	28	22	20	18	24	21	18	20	24
II.	17	22	28	26	20	20	20	18	20	20	18	17
III.	24	24	21	23	17	17	21	22	16	18	18	22
IV.	28	30	24	24	22	28	25	25	24	25	23	22
V.	23	24	29	24	24	21	26	23	28	26	22	24
VI.	26	25	22	28	18	18	14	18	21	25	16	20
VII.	28	25	20	30	27	27	24	24	24	30	22	26
VIII.	18	22	22	22	22	18	19	21	16	13	15	18
IX.	24	29	22	29	22	19	20	22	20	18	21	20
X.	22	18	24	18	17	24	18	21	20	21	24	21
XI.	22	31	24	16	25	19	20	20	24	24	15	19
XII.	16	21	24	24	14	21	18	22	20	20	21	22

Actual weights in lb.—Straw.

Row.	1	2	3	4	5	6	7	8	9	10	11	12
I.	44	54	50	62	54	60	67	62	61	59	52	62
II.	42	48	45	44	54	49	54	50	54	58	55	50
III.	53	46	48	48	52	50	56	56	51	54	56	53
IV.	42	48	44	46	47	53	52	52	58	55	55	54
V.	57	50	60	54	62	62	52	62	61	64	52	65
VI.	51	44	44	48	46	55	50	51	61	58	46	50
VII.	49	46	48	55	61	62	46	52	61	58	54	56
VIII.	46	36	44	42	54	53	50	44	43	47	47	52
IX.	43	50	46	38	54	48	76	54	53	76	53	48
X.	50	51	49	49	51	54	54	61	58	62	54	51
XI.	42	49	49	42	55	44	46	48	51	56	40	45
XII.	49	45	49	46	48	49	46	52	48	60	54	58

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SUMMARY OF RESULTS.

Separate yields. Mean of all seed mixtures.

Average yield in cwt. per acre.		No Nitrogen.		Sulphate of Ammonia.		Nitrate of Soda.	
		Without Mur.Pot.	With Mur.Pot.	Without Mur.Pot.	With Mur.Pot.	Without Mur.Pot.	With Mur.Pot.
Hay—Dry matter	No Super ..	47.9	47.9	50.7	55.6	53.5	56.4
	Super	47.1	45.7	53.5	50.3	53.9	55.1
Grain and Pulse	No Super ..	20.2	21.6	18.6	18.8	18.9	19.2
	Super	21.4	21.7	18.1	19.3	17.5	19.0
Straw	No Super ..	42.3	42.2	47.5	47.5	49.1	52.6
	Super	42.9	42.7	48.3	47.9	46.0	47.9

Standard Errors : Hay, Dry Matter : 1.23 cwt. or 2.39 per cent.
Grain and Pulse : 0.69 cwt. or 3.54 per cent.
Straw : 1.05 cwt. or 2.26 per cent.

Mean of all manurial treatments.

Average yield in cwt. per acre.	Hay, Dry Matter.			Grain and Pulse.			Straw.		
	Oats.	Wheat.	Means (a)	Oats	Wheat .	Means (a)	Oats.	Wheat.	Means (a)
Vetches	54.1	51.7	52.9	21.4	20.1	20.8	47.8	47.7	47.8
Peas	50.7	49.4	50.0	18.2	18.4	18.3	45.7	44.3	45.0
Means (b)	52.4	50.5	51.5	19.8	19.3	19.5	46.8	46.0	46.4
Standard Errors—									
Means (a)		0.301			0.447			0.287	
Means (b)		1.277			0.745			1.290	

Mean of potash and no potash.

Average yield.	Cwt. per acre.				per cent			
	No Nitrogen	Sulphate of Ammonia	Nitrate of Soda	Mean	No Nitrogen	Sulphate of Ammonia	Nitrate of Soda	Mean
Hay, Dry Matter—								
No Super ..	47.9	53.1	55.0	52.0	93.0	103.2	106.8	101.0
Super	46.4	51.9	54.5	50.9	90.2	100.8	105.9	99.0
Mean	47.1	52.5	54.7	51.5	91.6	102.0	106.4	100.0
Grain and Pulse—								
No Super ..	20.9	18.7	19.0	19.6	107.2	95.6	97.5	100.1
Super	21.6	18.7	18.2	19.5	110.5	95.8	93.3	99.9
Mean	21.3	18.7	18.6	19.5	108.8	95.7	95.4	100.0
Straw—								
No Super ..	42.2	47.5	50.9	46.9	91.0	102.4	109.6	101.0
Super	42.8	48.1	46.9	45.9	92.2	103.7	101.2	99.0
Mean	42.5	47.8	48.9	46.4	91.6	103.0	105.4	100.0

Standard Errors : Hay, Dry Matter : 0.869 cwt. or 1.69 per cent.
Grain and Pulse : 0.488 cwt. or 2.50 per cent.
Straw : 0.741 cwt. or 1.60 per cent.

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Mean of nitrogen and no nitrogen.

Average yield.	cwt. per acre.			per cent.		
	No Potash.	Potash.	Mean.	No Potash.	Potash.	Mean.
Hay, Dry Matter—						
No Super	50.7	53.3	52.0	98.5	103.6	101.0
Super	51.5	50.4	50.9	100.1	97.8	99.0
Mean	51.1	51.8	51.5	99.3	100.7	100.0
Grain and Pulse—						
No Super	19.2	19.9	19.6	98.5	101.7	100.1
Super	19.0	20.0	19.5	97.3	102.5	99.9
Mean	19.1	19.9	19.5	97.9	102.1	100.0
Straw—						
No Super	46.3	47.4	46.9	99.7	102.2	101.0
Super	45.7	46.2	45.9	98.5	99.5	99.0
Mean	46.0	46.8	46.4	99.1	100.9	100.0

Standard Errors : Hay, Dry Matter : 0.709 cwt. or 1.38 per cent.
Grain and Pulse : 0.399 cwt. or 2.04 per cent.
Straw : 0.605 cwt. or 1.30 per cent.

Differences of seed mixtures : In all cases the vetch mixtures give higher yields than the pea mixtures, and the oats mixtures give higher yields than the wheat mixtures, but the first of these differences only reaches the level of significance in the hay green weights, and the second only in the hay green weights and hay dry matter. (The experiment is not capable of giving a very precise verdict on these points.)

Manurial Effects : Nitrogen is significantly beneficial in the case of the hay and the straw, but significantly depresses the yield of grain and pulse. Nitrate of soda gives a significantly higher yield than Sulphate of Ammonia in the case of the hay and the straw ; in the case of the grain and pulse there is no significant difference. Potash significantly increases the yield of grain and pulse, and of hay weighed in the green state, but it has no significant effect on the straw, and no average effect on the hay dry matter. Phosphate shows no general effects.

For the hay dry matter the higher yield of plots receiving either potash or phosphate compared with those receiving neither or both is statistically significant, as is the higher yield in straw of the nitrate of soda plots receiving no phosphate compared with those receiving phosphate. There is no evidence that the manures act differently on the different types of crop.

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POTATOES

Nitrogenous Fertiliser: Sulphate of Ammonia.

Potassic Fertilisers: Sulphate and Muriate of Potash and Potash Salts (30%).

Each in single and double dressings.

Superphosphate.

R P—Pastures, 1931

N.W.

	G			D			A			
	— 8M	— 7S	— 4S	2 —	— 6P	8S —	6S —	— 8P	3 —	
	— 1	3 —	5P —	— 1	— 9M	7P —	— 9S	— 7M	— 4P	
	2 —	6M —	— 9P	— 3	4M —	5S —	— 1	— 2	5M —	
	1 —	4M —	7M —	7S —	— 6S	— 5M	— 8S	1 —	9M —	
H	5S —	— 8P	— 9S	— 1	— 4P	8M —	3 —	— 4S	2 —	B
	— 2	6P —	3 —	— 3	9P —	— 2	7P —	6M —	5P —	
	3 —	9M —	4P —	— 2	— 5P	9S —	9P —	— 8M	— 1	
I	— 5M	8S —	2 —	— 6M	8P —	— 3	— 7S	3 —	4M —	C
	1 —	— 7P	— 6S	— 7M	— 4S	— 1	5S —	— 2	6P —	

F

SYSTEM OF REPLICATION: 9 randomised blocks of 9 plots each. Each plot divided into 2 sub-plots.

AREA OF EACH SUB-PLOT: 1/100th acre.

TREATMENTS: Testing 0, 0.2 and 0.4 cwt. per acre N in form of Sulphate of Ammonia, 0, 0.4 and 0.8 cwt. per acre K_2O in the form of Sulphate of Potash, Muriate of Potash and Potash Salts.

Superphosphate at the rate of 0.5 cwt. per acre P_2O_5 applied to one out of each pair of sub-plots, indicated by the treatment symbol occurring on that half.

Farmyard manure: 14 tons per acre, approximately, applied to previous crop of Kale.

Manures applied: April 10th.

Potatoes planted: April 13th.

Potatoes lifted: Sept. 30th-Oct. 6th.

Variety: Ally.

Previous Crop: Kale fed off by sheep.

Key to Treatments.

Treatment No.	1	2	3	4	5	6	7	8	9
Sulph./Amm.	0	1	2	0	1	2	0	1	2
Potash ..	0	0	0	1	1	1	2	2	2

Actual weights in lb.—Sub-plots with Phosphate.

S/Amm	Potash	Blocks. A	B	C	D	E	F	G	H	I
Quantities										
0	0	256.00	253.00	251.25	213.75	264.50	255.00	199.00	275.00	255.00
0	1	198.75	284.00	297.50	189.00	259.50	236.75	171.50	253.50	263.75
0	2	213.25	326.75	327.50	216.25	239.00	157.25	183.25	243.75	163.25
1	0	243.00	271.75	291.75	212.75	298.75	287.75	223.75	239.75	306.00
1	1	243.75	267.25	340.25	223.00	258.75	286.75	227.25	257.25	245.00
1	2	236.75	321.00	303.50	218.50	274.50	306.25	187.75	280.25	310.75
2	0	247.50	329.00	355.25	228.25	317.50	326.25	227.50	329.25	282.75
2	1	256.50	306.00	305.50	222.50	259.25	298.00	258.50	294.50	233.75
2	2	279.50	250.25	350.25	256.50	308.50	289.00	263.00	313.00	285.00

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Actual weights in lb.—Sub-plots without Phosphate.

S/Amm	Potash	A	B	C	D	E	F	G	H	I
Quantities										
0	0	244.75	241.50	252.75	194.75	251.50	275.50	176.25	249.00	151.25
0	1	210.75	262.25	302.00	207.50	226.00	262.25	206.25	242.00	256.50
0	2	238.25	337.00	334.75	204.00	224.50	264.00	207.25	225.50	249.75
1	0	250.00	250.25	303.75	200.00	283.00	261.00	241.25	232.50	266.00
1	1	221.00	282.00	300.25	232.50	256.75	264.00	194.50	255.50	256.75
1	2	217.75	294.00	330.25	203.25	301.50	280.00	211.00	240.25	266.25
2	0	251.50	318.75	354.25	188.00	279.50	319.00	216.50	286.25	258.50
2	1	262.50	318.75	277.00	183.25	243.75	299.75	261.50	275.50	285.50
2	2	249.25	244.25	347.75	203.75	283.50	307.00	207.50	281.75	289.00

Summary of Results.

Effect of Quantity of Nitrogenous and Potassic Fertilisers, in relation to Superphosphate.

		Average yield in tons per acre.				Average yield per cent.			
		No S/Amm.	Single S/Amm.	Double S/Amm.	Mean.	No S/Amm.	Single S/Amm.	Double S/Amm.	Mean.
Without Super	No Potash ..	10.11	11.35	12.26	11.24	87.4	98.1	106.0	97.2
	Single Potash..	10.79	11.23	11.94	11.32	93.3	97.1	103.3	97.9
	Double Potash	11.33	11.63	11.97	11.65	98.0	100.5	103.5	100.7
Mean		10.74	11.40	12.06	11.40	92.9	98.6	104.3	98.6
With Super	No Potash ..	11.02	11.78	13.11	11.97	95.3	101.9	113.4	103.5
	Single Potash..	10.69	11.65	12.08	11.47	92.4	100.8	104.4	99.2
	Double Potash	10.27	12.10	12.87	11.75	88.8	104.6	111.3	101.6
Mean		10.66	11.84	12.69	11.73	92.2	102.4	109.7	101.4
Mean of super and no super		10.70	11.62	12.37	11.57	92.5	100.5	107.0	100.0

Standard Errors: Single treatment : 0.385 tons or 3.33%.
Mean of 3 treatments : 0.222 tons or 1.92%.
Mean of Super. and no Super. : 0.189 tons or 1.64%.

Effect of Quantity and Quality of Potassic Fertilisers, in relation to Superphosphate.

		Average yield in tons per acre.			Average yield per cent.		
		Sulphate of Potash.	Muriate of Potash.	Potash Salts.	Sulphate of Potash.	Muriate of Potash.	Potash Salts.
Without Super	No Potash ..		11.24			97.2	
	Single Potash ..	11.46	11.74	10.76	99.1	101.5	93.0
	Double Potash ..	11.75	11.45	11.74	101.6	99.0	101.5
Mean of Single and Double Potash		11.60	11.59	11.25	100.3	100.2	97.3
With Super	No Potash ..		11.97			103.5	
	Single Potash ..	11.22	11.66	11.54	97.0	100.8	99.7
	Double Potash ..	12.31	10.77	12.16	106.4	93.1	105.1
Mean of Single and Double Potash		11.77	11.21	11.85	101.7	97.0	102.4

Standard Errors: Single treatment = 0.385 tons or 3.33%.
Means = 0.272 tons or 2.35%.

Definitely significant response to sulphate of ammonia and significant response to superphosphate. No response to Potash.

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SUGAR BEET

Correction to 1929 Experiment.

A further examination of this experiment revealed certain defects which vitiate the original analysis. A new analysis has now been made. The principal correction is that the standard errors given in the original summary of results (1929 Report, p. 103-5) are considerably too small.

No standard errors applicable for all comparisons can be assigned to the tables (*a*), of separate treatments. The standard errors of table (*b*), comparing Sulphate of Ammonia, Nitrate of Soda and no nitrogen, should be :

	Roots.	Tops.	Sugar Percentage.
Tons per acre	0.093	0.070	
Per cent.	1.25	1.30	0.068

and the summary under (*b*) stands without correction.

No response to or interaction with phosphate is significant. Table (*c*) should therefore read as follows :

(*c*) **Effect of Salt and Chloride of Potash, averaging for Variety, Phosphate and Nitrogen.**

	Roots.			*Tops.*		
Average yield— tons per acre.	Without Mur./Pot.	With Mur./Pot.	Mean.	Without Mur./Pot.	With Mur./Pot.	Mean.
Without Salt ..	7.28	7.38	7.33	5.13	5.35	5.24
With Salt	7.54	7.52	7.53	5.56	5.60	5.58
Mean	7.41	7.45	7.43	5.34	5.48	5.41
Standard Error ..		0.107			0.081	

The summary should read :

The increase of yield due to salt is barely significant in the case of the roots, but is definitely significant in the case of the tops. Muriate of Potash shows no significant effects.

The standard errors given in Table (*d*) do not apply to the comparisons shown, and no effect of phosphate or variety can claim to be clearly significant. The same applies even more strongly to the possible interactions discussed at the foot of p. 105 ; none of these seem to produce effects of any importance.

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Sugar Beet: Comparison of Dunging immediately before ploughing, and three weeks previously. Test of loosening sub-soil by hand digging. Variation in spacing.

R S—Great Harpenden—1931

A N.E. B

7	5	8	3	2	7	1	5
6	1	4	2	4	8	3	6
6	5	8	3	1	4	2	5
2	4	1	7	6	3	7	8
6	4	1	2	2	7	3	5
3	8	7	5	8	6	4	1

C D

E F

Key to Treatments.

1	2	3	4	5	6	7	8
D 1 P S1	D2 P S1	D1 H S1	D2 H S1	D1 P S2	D2 P S2	D1 H S2	D2 H S2

System of Replication: 6 randomised blocks of 8 plots each.

Area of Each Plot: .00368 acre.

Variety: Kuhn.

Treatments: All combinations of: dunged three weeks before ploughing (D1) *v* dunged immediately before ploughing (D2). Ploughed only (P) *v* Ploughed and hand dug (H), Spacing 16 ins. by 16 ins. (S1) *v* Spacing 24 ins. by 10 2/3rd ins. (S2). Dung at the rate of 20 tons per acre.

Basal Dressing: Sulphate of Ammonia at the rate of 0.4 cwt. N per acre, K cl at the rate of 0.6 cwt. K_2O per acre, Superphosphate at the rate of 0.3 cwt. P_2O_5 per acre.

Seed sown: May 8-9th.

Beet lifted: Oct. 31-Nov. 3rd.

Previous crop: Temporary ley, 1st crop taken for hay. Aftermath eaten off by sheep, which were also fed on turnips and corn.

Actual weights in lb.

Block.	Roots (dirty)							
	1	2	3	4	5	6	7	8
A ..	117	127	110	120	108	118	104	108
B ..	111	130	112	126	96	112	106	119
C ..	128	127	124	128	112	118	118	117
D ..	126	128	122	124	109	121	110	102
E ..	126	132	118	122	113	119	116	115
F ..	119	132	114	122	100	112	111	122
	Tops.							
A ..	127	143	118	138	120	129	113	134
B ..	120	136	126	142	109	134	118	144
C ..	130	135	115	162	126	132	138	128
D ..	132	146	134	132	134	140	130	126
E ..	141	154	119	143	121	140	133	136
F ..	128	150	120	124	108	128	131	143

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Block.	Sugar Percentage.							
	1	2	3	4	5	6	7	8
A ..	19.26	19.38	19.38	19.53	19.20	19.61	18.86	19.32
B ..	18.76	18.98	19.47	19.43	18.76	18.70	19.20	18.81
C ..	19.03	19.09	20.06	19.50	20.06	19.61	18.86	19.38
D ..	19.32	18.53	19.61	19.38	18.92	19.03	19.90	19.20
E ..	19.32	19.26	19.61	19.67	19.26	18.98	19.61	19.09
F ..	19.61	18.52	19.06	19.38	20.06	18.86	18.70	19.26

Summary of Results.

Average yield.		tons per acre.			per cent.		
		Spacing 16″ × 16″	Spacing 24″ × 10⅔″	Mean.	Spacing 16″ × 16″	Spacing 24″ × 10⅔″	Mean.
Dunged Early	*Roots* (washed) Ploughed only ..	13.07	11.47	12.27	103.3	90.6	97.0
	Ploughed and hand dug	12.58	11.96		99.4	94.5	
	Mean	12.83	11.71		101.4	92.6	
Dunged Late	Ploughed only ..	13.95	12.58	13.04	110.2	99.4	103.0
	Ploughed & hand dug	13.34	12.28		105.4	97.0	
	Mean	13.64	12.43		107.8	98.2	
Mean of dunged early and late ..		13.24	12.08	12.66	104.6	95.4	100.0
Mean of ploughed only ..		13.51	12.02		106.8	095.	
Mean of ploughed and dug ..		12.96	12.12		102.4	95.8	
Dunged Early	*Tops*— Ploughed only ..	15.73	14.52	15.12	98.6	91.0	94.8
	Ploughed & hand dug	14.80	15.43		92.8	96.7	
	Mean	15.26	14.97		95.7	93.9	
Dunged Late	Ploughed only ..	17.47	16.24	16.78	109.5	101.8	105.2
	Ploughed & hand dug	17.00	16.40		106.6	102.8	
	Mean	17.24	16.32		108.1	102.3	
Mean of dunged early and late ..		16.25	15.64	15.95	101.9	98.1	100.0
Mean of ploughed only ..		16.60	15.38		104.0	96.4	
Mean of ploughed and dug ..		15.90	15.92		99.7	99.8	

Sugar Percentage in Roots.	Ploughed only.		Ploughed and hand dug.	
	Spacing 16″ × 16″	Spacing 24″ × 10⅔″	Spacing 16″ × 16″	Spacing 24″ × 10⅔″
Dunged early	19.22	19.38	19.53	19.19
,, late	18.96	19.13	19.48	19.18
Mean	19.09	19.26	19.50	19.18

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Standard Errors.

	Tons per acre.			Per cent.		
	Single treatment.	Mean of 2 treatments.	Mean of 4 treatments.	Single treatment.	Mean of 2 treatments.	Mean of 4 treatments.
Roots ..	0.210	0.148	0.105	1.66	1.17	0.83
Tops ..	0.417	0.295	0.209	2.62	1.85	1.31
Sugar %	0.145	0.103	0.073	—	—	—

Definitely significant effect of time of applying dung, both on roots and tops, the later application being superior. The square spacing is significantly superior to the rectangular spacing, in general, and the effect is significantly greater on the plots without hand digging, both as regards roots and tops. The sugar percentage is significantly higher on the hand dug plots with square spacing than on the remaining plots. Taken in conjunction with the yields this implies that the total yield of sugar is significantly increased by square spacing, but is not affected by hand digging.

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REPLICATED EXPERIMENTS AT WOBURN

Sugar Beet: Nitrogenous Fertilisers, Sulphate of Ammonia and Nitrate of Soda.

Chloride Dressing, Sodium Chloride.

W S—Butt Furlong, 1931 (Micro-Plots)

N.E.

I.	4	5	6	1	2	3
II.	3	2	1	5	4	6
III.	6	4	3	2	5	1
IV.	2	6	5	3	1	4
V.	5	1	4	6	3	2
VI.	1	3	2	4	6	5

SYSTEM OF REPLICATION: 6×6 Latin Square.

AREA OF EACH PLOT: 0.00155 acre.

VARIETY: Kuhn.

TREATMENTS: No nitrogen *v* Sulphate of Ammonia *v* Nitrate of Soda at the rate of 0.53 cwt. N per acre, Sodium Chloride at the rate of 1.3 cwt. Cl. per acre.

All plots received carbonate of lime at the rate of 1 ton per acre, Superphosphate at the rate of 0.4 cwt. P_2O_5 per acre, and Muriate of Potash at the rate of 0.8 cwt. K_2O per acre.

Manures applied: May 9th.

Seed sown: May 9th.

Beet Lifted: Nov. 23rd.

Previous crop: Seeds sown among barley.

Key to Treatments.

Treatment.	1	2	3	4	5	6
Sulphate of Ammonia		x			x	
Nitrate of Soda			x			x
Sodium Chloride		x		x		x

Yields in lb. corrected to constant plant number (46).

Row.	Roots (washed).						Tops.					
	1	2	3	4	5	6	1	2	3	4	5	6
I. ..	36	48	42	40	48	47	42	64	74	55	71	76
II. ..	32	47	42	46	50	41	46	65	72	40	56	61
III. ..	31	43	48	34	41	47	43	51	64	43	51	74
IV. ..	29	53	48	37	49	53	44	80	68	52	69	77
V. ..	36	49	42	39	47	48	43	67	60	47	63	64
VI. ..	37	47	48	39	50	44	48	61	62	55	67	63

Row.	Sugar Percentage.					
	1	2	3	4	5	6
I.	17.50	17.56	16.70	17.50	17.44	16.75
II.	17.10	17.22	16.70	17.39	17.27	16.42
III.	16.36	16.76	16.48	16.76	16.48	17.27
IV.	16.25	17.22	16.87	16.82	17.00	16.93
V.	18.01	17.22	16.47	17.50	16.92	17.62
VI.	17.22	18.02	16.70	17.44	17.56	17.84

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Summary of Results corrected to constant plant number (46).

Average yield.	Tons per acre.				Per cent.			
	No Nitrog.	S/Amm.	N/Soda	Mean.	No Nitrog.	S/Amm.	N/Soda	Mean.
Roots—								
Without Chloride ..	9.65	13.68	12.96	12.10	77.4	109.8	104.0	97.0
With Chloride	11.28	13.78	13.44	12.83	90.5	110.5	107.8	103.0
Mean	10.46	13.73	13.20	12.46	84.0	110.1	105.9	100.0
Tops—								
Without Chloride ..	12.77	18.10	19.20	16.69	74.6	105.8	112.2	97.6
With Chloride	14.02	18.62	19.92	17.52	81.9	108.9	116.5	102.4
Mean	13.39	18.36	19.56	17.10	78.3	107.3	114.4	100.0

Sugar percentage.	No Nitrogen.	S/Amm.	N/Soda.	Mean.
Without Chloride	17.07	17.11	16.65	16.95
With Chloride	17.24	17.33	17.14	17.24
Mean	17.15	17.22	16.90	17.09

Standard Errors.

	Tons per acre.			Per cent.		
	Single treatment.	Mean of 2 treatments.	Mean of 3 treatments.	Single treatment.	Mean of 2 treatments.	Mean of 3 treatments.
Roots	0.430	0.302	0.248	3.45	2.44	1.99
Tops	0.510	0.361	0.294	2.98	2.11	1.72
Sugar percentage ..	0.156	0.110	0.090	—	—	—

The effect of the nitrogenous dressings is definitely significant. Nitrate of Soda is significantly superior to Sulphate of Ammonia in the case of the tops, but is not significantly inferior in the case of the roots. The effect of chloride is just significant. The sugar percentage is significantly increased by sodium chloride ; the depression with Nitrate of Soda is not significant.

L

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Sugar Beet: Nitrogenous Fertilisers, Sulphate of Ammonia and Nitrate of Soda.

Chloride Dressing: Agricultural Salt (NaCl), comparison of early and late dressings.

Incorporation of Fertilisers by means of Simar or Harrow.

W S—Butt Furlong, 1931.

N.

A			B			C		
12	3	7	6	11	3	5	2	9
5	1	11	1	7	10	8	6	12
2	8	9	12	8	4	7	3	11
4	10	6	5	2	9	10	4	1
11	1	4	5	4	12	6	7	4	5	10	11
10	2	8	9	5	3	8	11	8	9	3	7
3	7	12	6	9	1	10	2	12	2	1	6
3	10	11	7	1	5	6	9	10	1	6	2	4	9	5	3	2	11	12	10	2	7	8	6
1	5	2	8	12	10	7	11	4	11	3	8	6	2	12	7	8	5	7	6	10	12	5	4
9	12	6	4	3	4	8	2	9	7	12	5	1	11	8	10	9	3	1	4	1	3	11	9

D F

G H I J K L

Key to Treatments.

Treatm't	Nitrogen	Salt.	Time of Appl'n
1	O	O	E
2	S	O	E
3	N	O	E
4	O	I	E
5	S	I	E
6	N	I	E
7	O	O	L
8	S	O	L
9	N	O	L
10	O	I	L
11	S	I	L
12	N	I	L

System of Replication: 12 randomised blocks of 12 plots each, one block of each pair being simared.

Area of Each Plot: 1/90th acre.

Variety: Kuhn.

Treatments: No Nitrogen *v* Sulphate of Ammonia *v* Nitrate of Soda at the rate of 0.6 cwt. N per acre. Agricultural Salt at the rate of 1.5 cwt. Cl per acre.

The whole of the area was treated with 1 ton of Carbonate of Lime per acre. All plots received Superphosphate at the rate of 0.5 cwt. P_2O_5 per acre and Muriate of Potash at the rate of 1 cwt. K_2O per acre.

The whole of the manures were applied early (E), three weeks before sowing, or late (L), at time of sowing.

Blocks B, D, F, H, J, K were simared after first manurial dressing and all other blocks harrowed. Simaring was tested against harrowing as a method of incorporating the manures with the soil, rather than as a cultivation treatment.

Manures applied early: April 17th. Late: May 8th.

Seed sown: May 8th.

Beet Lifted: November 4th-18th.

Previous crop: Seeds sown among barley.

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Weights in lb. corrected to constant plant number (100)—Roots (dirty).

Block.	1	2	3	4	5	6	7	8	9	10	11	12
A ..	132.7	158.7	121.6	127.9	125.2	146.0	116.8	145.4	131.9	112.8	150.7	128.1
B ..	146.6	109.4	132.9	115.8	138.6	143.5	123.8	144.3	122.5	119.5	157.3	139.3
C ..	97.6	142.0	108.4	79.2	140.6	117.7	83.5	158.5	132.5	75.0	143.7	139.0
D ..	61.6	80.0	104.7	75.6	99.3	83.7	70.5	111.6	87.6	70.6	103.1	89.9
E ..	76.7	105.9	75.7	78.3	95.0	96.4	83.4	108.7	97.1	67.9	102.8	107.6
F ..	72.6	98.1	77.1	72.2	92.4	101.1	77.3	107.5	107.2	62.9	118.0	114.4
G ..	77.3	104.0	102.8	95.3	106.0	98.0	84.4	110.9	113.2	75.7	113.3	108.1
H ..	104.1	124.9	115.5	108.6	106.9	68.0	75.7	125.0	113.6	93.0	118.4	121.0
I ..	68.2	96.6	88.9	87.0	122.2	70.3	93.7	102.7	124.2	84.2	114.0	119.1
J ..	100.4	106.9	77.3	70.1	96.5	88.9	76.5	128.9	113.9	112.8	144.3	113.7
K ..	97.6	95.8	105.2	95.7	93.6	86.5	70.8	114.4	135.1	92.3	116.5	102.5
L ..	96.2	120.0	108.0	96.6	127.9	126.9	108.5	138.4	114.9	95.9	127.5	129.1

Weights in lb. corrected to constant plant number (100)—Tops.

Block.	1	2	3	4	5	6	7	8	9	10	11	12
A ..	112.9	145.4	123.3	103.9	127.6	155.6	93.4	130.7	130.5	93.4	127.4	125.9
B ..	126.2	93.0	123.0	92.5	125.2	127.5	69.6	127.9	121.0	95.4	81.4	160.7
C	90.1	140.9	141.0	59.7	128.9	163.8	83.3	146.9	75.6	56.0	180.5	194.6
D ..	37.2	62.9	104.4	46.5	75.2	55.2	43.3	77.1	64.8	55.7	87.7	65.4
E ..	43.6	74.5	51.9	47.0	75.0	73.0	50.1	61.4	66.0	37.8	72.5	87.6
F ..	34.8	61.1	48.5	44.6	62.1	64.9	43.3	74.2	76.5	35.6	89.5	81.9
G ..	67.0	107.0	101.5	84.2	106.0	103.1	69.9	122.7	118.5	54.4	101.4	111.9
H ..	96.9	100.9	120.1	88.0	101.0	46.8	50.0	100.5	88.2	71.0	85.2	130.2
I ..	39.6	62.7	53.4	60.9	88.5	39.4	57.5	71.4	102.4	49.1	87.4	93.4
J ..	70.4	67.3	45.1	38.4	68.9	63.0	38.6	86.4	84.7	69.3	112.9	84.7
K ..	63.2	66.9	76.1	68.9	66.1	71.6	45.6	65.7	112.6	70.0	79.2	92.9
L ..	70.0	108.8	100.5	81.5	114.1	131.8	81.6	128.8	120.5	79.1	124.4	125.9

Sugar Percentage in Roots.

Block.	1	2	3	4	5	6	7	8	9	10	11	12
A ..	17.13	17.56	16.07	17.56	17.39	17.41	17.76	17.62	17.22	17.27	16.88	16.87
B ..	17.04	17.22	17.22	17.84	17.38	16.67	17.62	18.01	17.56	18.24	17.68	16.99
C ..	17.73	17.79	16.65	17.68	17.98	17.04	17.44	17.90	16.47	17.04	16.42	16.93
D ..	17.90	17.61	17.24	17.62	17.89	18.30	18.64	17.73	18.24	18.53	17.84	18.47
E ..	18.42	18.24	18.48	17.95	18.18	17.74	18.12	18.12	18.61	19.24	17.96	17.78
F ..	18.84	18.30	18.07	18.18	18.06	17.95	18.24	18.07	18.41	18.35	18.01	19.10
G ..	17.56	18.35	17.56	18.13	18.04	17.22	18.36	18.19	18.04	18.41	18.96	18.07
H ..	18.24	18.04	17.58	17.95	18.24	18.07	18.18	18.58	18.39*	18.06	18.52	17.73
I ..	18.86	18.19	18.64	18.12	17.95	19.02	18.75	18.30	18.44	18.98	18.71	18.70
J ..	18.99	18.19	18.70	18.93	18.70	18.02	18.38	17.68	19.21	17.95	18.99	18.12
K ..	18.35	18.64	17.78	18.24	17.62	17.62	18.41	19.21	18.42	18.25	19.38	17.73
L ..	17.50	18.18	17.73	17.56	17.79	17.79	17.96	16.93	17.84	18.27	17.78	17.78

* Estimated.

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Summary of Results corrected to constant plant number (100).

Average yield.		Early			Late		
		No Nitrogen	S/Amm.	N/Soda	No Nitrogen	S/Amm.	N/Soda
Roots (washed) tons per acre	Harrowed and no salt	—	12.94	10.78	9.96	13.61	12.71
	Harrowed and salt	10.04	12.76	11.66	9.10	13.39	13.01
	Simared and no salt	—	10.95	10.91	9.59	13.03	12.10
	Simared and salt ..	9.58	11.17	10.18	9.81	13.49	12.12
Roots— per cent.	Harrowed and no salt	—	112.6	93.8	86.6	118.4	110.5
	Harrowed and salt	87.4	111.0	101.5	79.2	116.5	113.2
	Simared and no salt	—	95.2	94.9	83.4	113.3	105.3
	Simared and salt ..	83.3	97.2	88.5	85.3	117.3	105.4
Tops— tons per acre	Harrowed and no salt	—	15.41	13.78	10.35	15.96	14.79
	Harrowed and salt	10.54	15.43	16.07	8.91	16.72	17.82
	Simared and no salt	—	10.90	12.47	8.67	12.82	13.20
	Simared and salt ..	9.13	12.02	10.34	9.57	12.92	14.84
Tops— per cent.	Harrowed and no salt	—	119.9	107.2	80.6	124.2	115.1
	Harrowed and salt	82.0	120.1	125.1	69.4	130.1	138.7
	Simared and no salt	—	84.8	97.0	67.5	99.8	102.8
	Simared and salt	71.1	93.5	80.5	74.5	100.5	115.5
Sugar Percentage—	Harrowed and no salt	—	18.05	17.52	17.97	17.84	17.77
	Harrowed and salt	17.83	17.89	17.70	18.20	17.78	17.69
	Simared and no salt	—	18.00	17.76	18.24	18.21	18.37
	Simared and salt	18.13	17.98	17.77	18.23	18.40	18.02

Standard Errors : Roots : 0.869 tons or 7.65 per cent.
Tops : 1.702 tons or 13.54 per cent.
Sugar Percentage : 0.252.

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Effect of Nitrogenous Manures.

Mean of Salt and No Salt.		No Nitrogen.	S/Amm.	N/Soda.	Mean.	Standard Error.
Roots— tons per acre	Early ..	9.81*	11.96	10.88	10.88	0.270
	Late.. ..	9.62	13.38	12.48	11.83	
	Mean ..	9.72	12.67	11.68	11.36	
Roots— per cent.	Early ..	85.4*	104.0	94.7	94.7	2.35
	Late.. ..	83.6	116.4	108.6	102.9	
	Mean ..	84.5	110.2	101.6	98.8	
Tops— tons per acre	Early ..	9.84*	13.44	13.16	12.15	0.528
	Late.. ..	9.38	14.60	15.16	13.05	
	Mean ..	9.61	14.02	14.16	12.60	
Tops— per cent.	Early ..	76.6*	104.6	102.4	94.5	4.11
	Late.. ..	73.0	113.6	118.0	101.5	
	Mean ..	74.8	109.1	110.2	98.0	
Sugar percentage—	Early ..	17.98*	17.98	17.68	17.88	0.088
	Late.. ..	18.16	18.06	17.96	18.06	
	Mean ..	18.07	18.02	17.82	17.97	

*The 12 plots without nitrogen or salt that should have received their basal dressing early received it late in error, and have been included in the late group.

Nitrogen is significantly beneficial, both to the roots and tops, and the late dressing of nitrogen is significantly superior to the early dressing. There is no indication that the late application of the basal manures is superior to the early application, except possibly in raising the sugar content.

Sulphate of ammonia is significantly superior to nitrate of soda for the roots, but there is no difference in the case of the tops.

Salt produced no effect, either in the early or late dressing.

Nitrogenous dressings significantly depress the sugar percentage ; the depression being significantly greater with nitrate of soda. The plots with early dressings have a significantly lower sugar content than those with late dressings ; this difference is most marked in the case of the sulphate of ammonia plots.

The difference between simaring and harrowing is not significant, (the experiment is incapable of giving a precise verdict on this point).

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REPLICATED EXPERIMENTS AT OUTSIDE CENTRES

Grassland. Meadow Hay.

(Basic Slag Committee).

W. Eydes, Esq., Walton Lodge Farm, Walton, Chesterfield, Derby, 1931. (DH-). Second Season.

Permanent grass.

I.	H —	L —	— M	— O	— S
II.	M —	H —	— O	S —	L —
III.	S —	O —	— L	M —	— H
IV.	— L	— M	— S	H —	O —
V.	O —	S —	— H	— L	— M

System of Replication: 5x5 Latin Square, plots split for Potash.
Area of Each Whole Plot: 1/15 acre.
Soil: Clay 6 in. deep.
Treatments:
O = No phosphate.
S = Superphosphate.
M = Mineral Phosphate.
L = Low Soluble Slag (Citric solubility 23.0%).
H = High soluble Slag (,, ,, 96.5%).
Muriate of Potash at the rate of 0.5 cwt. K_2O per acre applied to one out of each pair of sub-plots (indicated by the treatment symbol occurring on that half.)
Phosphatic dressings at the rate of 1 cwt. P_2O_5 per acre, applied March 18th.
Hay cut: July 27th.
Hay weighed: August 6-7th.

Actual weights in lb.—Dry Weights.

Row.	Without Muriate of Potash.					With Muriate of Potash.				
	O	S	M	L	H	O	S	M	L	H
I	76.7	94.4	86.3	102.5	104.7	88.5	106.9	98.8	104.7	117.2
II	97.3	108.4	117.2	97.3	107.6	99.5	112.8	123.1	101.0	120.9
III	113.9	111.7	112.1	115.6	107.6	117.2	126.2	120.9	116.1	120.9
IV	97.4	107.2	101.6	100.5	108.0	100.5	115.0	120.3	112.7	110.0
V	110.1	104.0	102.0	91.8	108.7	108.7	132.4	105.3	82.4	105.3

Summary of Results—Dry weights.

Average yield. cwt. per acre	No Phosphate	Mineral Phosphate.	Low Slag.	High Slag.	Super.	Mean.	Standard Error
Without Potash ..	26.5	27.8	27.2	28.8	28.2	27.7	0.789
With Potash	27.6	30.4	27.7	30.8	31.8	29.6	
Mean	27.0	29.1	27.4	29.8	30.0	28.7	0.658
Average yield. per cent.							
Without Potash ..	92.6	97.0	94.9	100.3	98.2	96.6	2.75
With Potash	96.1	106.2	96.6	107.3	110.8	103.4	
Mean	94.3	101.6	95.7	103.8	104.5	100.0	2.29

Significant response to mineral phosphate, to high soluble slag, and to superphosphate. The effect of potash is also significant.

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Grassland. Meadow Hay.

(Basic Slag Committee).

W. H. Limbrick, Esq., Badminton Farm, Badminton, Gloucester— 1931. (GH-). Second Season.

I.	A —	— B	C —	D —	E —
II.	D —	— C	— E	B —	A —
III.	B —	— E	— D	A —	C —
IV.	— E	A —	— B	C —	— D
V.	— C	D —	A —	— E	— B

Permanent grass.

SYSTEM OF REPLICATION: 5 × 5 Latin Square, plots split for Potash.

AREA OF EACH SUB-PLOT: 1/20th acre.

SOIL: Light red loam, 8 ins. deep.

TREATMENTS:
B = No phosphate.
A = Superphosphate.
D = Mineral Phosphate.
C = Low Soluble Slag (Citric solubility 23.0%).
E = High Soluble Slag (,, ,, 96.5%).

Half of each plot received 1 cwt. Muriate of Potash per acre, applied to one out of each pair of sub-plots (indicated by the treatment symbol occurring on that half).

Phosphatic dressings at the rate of 1 cwt. P_2O_5 per acre.

Hay cut: June 29th.

Hay weighed July 4th.

Actual weights in lb. (Green weights).

Row.	A	B	C	D	E	A	B	C	D	E
	With Muriate of Potash.					Without Muriate of Potash.				
I.	365.5	296.5	326.5	335.5	323.0	325.0	257.0	323.0	286.0	307.5
II.	303.0	321.0	327.5	304.5	389.5	323.0	336.5	300.5	337.0	358.0
III.	375.5	360.0	350.5	381.0	354.5	384 5	336.0	335.5	377.0	326.5
IV.	363.5	430.0	329.0	355.0	390.5	387.5	362.0	370.5	368.5	383.0
V.	448.5	426.5	350.0	378.5	434.0	413.5	347.5	351.0	386.5	398.5

Summary of Results (Dry weights).

Average yield cwt. per acre.	No Phosphate.	Mineral Phosphate.	Low Slag.	High Slag.	Super.	Mean.	Standard Error.
Without M/Pot	40.9	44.3	43.1	45.3	46.8	44.1	1.17
With M/Pot ..	45.3	43.1	43.4	47.9	47.1	45.4	
Mean	43.1	43.7	43.2	46.6	47.0	44.7	0.840
Average yield per cent.							
Without M/Pot	91.5	99.1	96.4	101.2	104.7	98.6	2.61
With M/Pot ..	101.3	96.3	96.9	107.2	105.3	101.4	
Mean	96.4	97.7	96.7	104.2	105.0	100.0	1.88

Significant response to high slag and to superphosphate. The response to muriate of potash is also significant. High slag and super are significantly superior to low slag but not to mineral phosphate.

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Barley: Effect of Nitrogenous Fertilisers, and of Sulphate of Potash and Superphosphate.

G. H. Nevile, Esq., Wellingore Hall, Lincs.—1931. (VB-).

Plan and Actual Weights.

Grain (dry weights) lb.								Straw (dry weights) lb.							
O	K	O	P	O	P	K	PK	O	K	O	P	O	P	K	PK
19.4	17.9	17.8	17.7	18.0	15.7	19.0	17.6	19.7	19.3	19.3	21.5	20.9	19.3	20.8	20.9
P	PK	K	PK	PK	K	P	O	P	PK	K	PK	PK	K	P	O
19.1	19.8	18.5	19.0	17.9	17.2	19.1	17.3	21.2	20.6	20.1	21.0	20.9	19.9	19.8	19.4
P	K	PK	O	P	K	K	P	P	K	PK	O	P	K	K	P
21.5	21.5	23.4	20.3	19.3	17.9	18.9	19.2	28.0	22.6	21.9	20.4	20.2	20.0	23.6	20.5
O	PK	K	P	PK	O	PK	O	O	PK	K	P	PK	O	PK	O
16.1	15.7	17.5	15.9	17.2	15.0	18.0	18.4	17.9	17.3	17.7	15.1	17.9	15.2	19.7	17.0
O	PK	P	O	P	K	P	K	O	PK	P	O	P	K	P	K
16.6	15.5	14.5	15.8	15.0	14.7	16.8	13.2	20.2	19.1	20.9	19.9	19.1	17.0	21.6	20.4
P	K	K	PK	PK	O	O	PK	P	K	K	PK	PK	O	O	PK
14.6	16.6	17.8	17.9	13.6	13.2	14.9	13.9	21.6	21.2	19.6	21.2	18.1	12.9	18.8	18.8
O	P	PK	K	K	PK	P	K	O	P	PK	K	K	PK	P	K
15.1	13.4	14.1	15.4	15.9	13.2	12.4	15.4	19.3	18.5	17.5	18.7	19.0	15.6	15.9	17.6
PK	K	O	P	P	O	O	PK	PK	K	O	P	P	O	O	PK
15.4	18.8	15.8	13.3	15.5	14.0	16.7	13.6	18.2	21.2	20.8	20.7	19.8	17.9	18.5	17.5

Straw computed by ratio of grain / total produce.

Plan showing Nitrogenous Treatments applied to whole plots.

O	S	N	C
S	O	C	N
N	C	O	S
C	N	S	O

SYSTEM OF REPLICATION: 4 × 4 Latin Square with plots sub-divided into 4.

AREA OF EACH WHOLE PLOT: 1/50th acre.

Soil: Light loam on Lincoln Heath.

Variety: Plumage Archer.

TREATMENTS:

O = No Nitrogen.
C = Cyanamide.
N = Nitrate of Soda.
S = Sulphate of Ammonia.
} at the rate of 0.2 cwt. N per acre.

Plots sub-divided to receive no Potash or Superphosphate (O), Sulphate of Potash (K), at the rate of 0.6 cwt. K_2O per acre, Superphosphate (P) at the rate of 0.4 cwt. P_2O_5 per acre, and Sulphate of Potash and Superphosphate (PK).

Plots harvested by sampling method.

Manures applied: March 27th.

Barley sown: March 27th.

Barley harvested: September 2nd.

Previous Crop: Oats.

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Summary of Results.

Average yield	Cwt. per acre					Per cent.				
	No Nitrogen	Sulph./ Amm.	Nitrate of Soda	Cyana-mide	Mean	No Nitrogen	Sulph./ Amm.	Nitrate of Soda	Cyana-mide	Mean
Grain—										
No Potash or Super...	31.1	28.0	30.7	28.2	29.5	104.1	94.0	102.9	94.6	98.9
Sulphate of Potash ..	29.2	30.8	30.4	32.8	30.8	98.0	103.4	101.9	110.0	103.3
Superphosphate ..	27.9	31.9	28.0	29.6	29.4	93.4	107.0	94.0	99.2	98.4
Potash and Super. ..	31.4	27.6	29.2	30.4	29.7	105.3	92.5	98.0	101.9	99.4
Mean	29.9	29.6	29.6	30.3	29.8	100.2	99.2	99.2	101.4	100.0
Straw—										
No Potash or Super.	31.9	33.0	35.2	33.0	33.3	91.8	94.8	101.2	94.7	95.6
Sulphate of Potash ..	32.0	36.6	37.2	36.4	35.6	91.9	105.4	107.0	104.7	102.2
Superphosphate ..	31.8	40.6	36.6	35.4	36.1	91.5	116.6	105.4	101.9	103.8
Potash and Super. ..	34.9	32.5	34.5	34.9	34.2	100.2	93.3	99.1	100.4	98.2
Mean	32.6	35.7	35.9	34.9	34.8	93.8	102.5	103.2	100.4	100.0

Standard Errors : Comparisons involving	Grain. cwt. per acre.	Grain. per cent.	Straw. cwt. per acre.	Straw. per cent.
Sub-treatments only, over a single main treatment	1.43	4.79	1.71	4.92
Sub-treatments only, over all main treatments	0.714	2.39	0.857	2.46
Main treatments, over a single sub-treatment	1.35	4.52	1.55	4.47
Main treatments, over the mean of all sub-treatments	0.531	1.78	0.460	1.32

The response to nitrogen by the straw is significant, but the grain shows no such response. There is no significant difference between the different forms of nitrogen. The superphosphate and potash produce no significant effects.

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Barley: Effect of Nitrogenous Fertilisers, and of Sulphate of Potash and Superphosphate.

H. B. Bescoby, Esq., South-Eastern Agricultural College, Wye, Kent—1931. (ZB-).

Plan and Actual Weights in grammes per sample.

Grain								Straw							
P	PK	P	PK	K	P	P	O	P	PK	P	PK	K	P	P	O
518	533	456	502	544	526	461	398	570	623	429	438	601	568	448	406
O	K	K	O	O	PK	K	PK	O	K	K	O	O	PK	K	PK
473	486	467	485	530	494	504	424	457	520	470	473	536	523	509	399
P	K	O	PK	K	P	P	K	P	K	O	PK	K	P	P	K
474	417	528	484	420	407	424	463	493	395	576	502	417	399	396	465
O	PK	K	P	PK	O	PK	O	O	PK	K	P	PK	O	PK	O
484	454	526	464	367	353	354	414	488	470	589	563	323	371	343	431
K	P	O	PK	O	K	O	PK	K	P	O	PK	O	K	O	PK
418	438	415	496	420	414	466	505	414	432	434	528	433	398	555	547
O	PK	P	K	P	PK	P	K	O	PK	P	K	P	PK	P	K
365	426	490	427	450	426	551	477	335	413	500	402	476	433	682	547
O	PK	PK	P	O	P	K	P	O	PK	PK	P	O	P	K	P
478	422	438	377	462	458	406	505	487	425	431	339	470	482	418	588
K	P	K	O	PK	K	O	PK	K	P	K	O	PK	K	O	PK
446	428	396	362	476	463	446	453	477	403	370	350	528	485	463	462

Plan showing Nitrogenous Treatments applied to whole plots.

N	C	S	O
S	N	O	C
O	S	C	N
C	O	N	S

SYSTEM OF REPLICATION: 4 × 4 Latin Square with plots sub-divided into 4.

AREA OF EACH WHOLE PLOT: 1/50th acre.

Soil: Silty Loam.

Variety: Plumage Archer.

TREATMENTS:

O = No Nitrogen.
C = Cyanamide.
N = Nitrate of Soda.
S = Sulphateof Ammonia } at the rate of 0.2 cwt. N per acre.

Plots sub-divided to receive no Potash or Superphosphate (O), Sulphate of Potash (K) at the rate of 0.6 cwt. K_2O per acre, Superphosphate (P) at the rate of 0.4 cwt. P_2O_5 per acre, and Sulphate of Potash and Superphosphate (PK).

Plots harvested by sampling method.

Manures applied: March 26th.

Barley sown: March 26th.

Harvested: August 14th.

Previous Crop: Barley.

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Summary of Results.

Average yield	Cwt. per acre					Per cent.				
	No Nitrogen	Sulph./ Amm.	Nitrate of Soda	Cyana-mide	Mean	No Nitrogen	Sulph./ Amm.	Nitrate of Soda	Cyana-mide	Mean
Grain.										
No Potash or Super...	18.4	23.3	24.0	22.4	22.0	81.4	103.3	106.3	99.0	97.5
Sulphate of Potash ..	21.6	22.3	24.3	22.3	22.6	95.8	98.9	107.6	98.6	100.2
Superphosphate ..	20.9	24.8	24.8	21.9	23.1	92.7	109.9	109.7	96.9	102.3
Potash and Super. ..	20.6	23.6	24.9	21.2	22.6	91.2	104.5	110.1	93.9	99.9
Mean	20.4	23.5	24.5	21.9	22.6	90.3	104.2	108.4	97.1	100.0
Straw.										
No Potash or Super.	18.2	23.9	25.6	22.7	22.6	78.2	102.8	110.1	97.6	97.2
Sulphate of Potash ..	21.3	22.6	26.6	22.5	23.3	91.5	97.2	114.6	96.9	100.0
Superphosphate ..	20.1	26.7	28.6	21.2	24.2	86.6	115.0	122.9	91.2	103.9
Potash and Super. ..	19.5	24.7	27.4	20.4	23.0	83.8	106.1	117.7	87.7	98.8
Mean	19.8	24.5	27.0	21.7	23.2	85.0	105.3	116.3	93.3	100.0

Standard Errors : comparisons involving	Grain. cwt. per acre.	Grain. per cent.	Straw. cwt. per acre.	Straw. per cent.
Sub-treatments only, over a single main treatment	0.754 or	3.34	1.140 or	4.92
Sub-treatments only, over all main treatments	0.377 or	1.67	0.570 or	2.46
Main treatments over a single sub-treatment	0.822 or	3.64	1.319 or	5.69
Main treatments over the mean of all sub-treatments	0.499 or	2.21	0.876 or	3.78

The response to nitrogen is definitely significant, the sulphate of ammonia and nitrate of soda being significantly superior to the cyanamide, both on grain and straw. There are no other significant effects.

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Barley: Effect of Nitrogenous Fertilisers, and of Sulphate of Potash and Superphosphate.

J. M. Templeton, Esq., Sparsholt Farm Institute—1931. (SB-).

Plan, and actual weights in grammes per sample.

Grain								Straw							
P 314	PK 323	P 283	K 316	O 288	PK 280	O 284	K 262	P 697	PK 467	P 405	K 586	O 474	PK 381	O 459	K 410
K 297	O 305	O 339	PK 345	K 338	P 297	P 299	PK 317	K 460	O 385	O 550	PK 537	K 471	P 460	P 484	PK 425
PK 406	K 380	PK 337	O 256	O 338	PK 316	PK 328	O 355	PK 633	K 577	PK 388	O 384	O 565	PK 474	PK 449	O 559
O 380	P 384	K 331	P 285	P 313	K 355	K 322	P 362	O 545	P 555	K 481	P 414	P 512	K 581	K 526	P 566
P 344	O 385	O 392	K 336	PK 388	P 367	PK 316	K 352	P 626	O 628	O 687	K 544	PK 748	P 585	PK 486	K 505
PK 457	K 423	P 373	PK 382	K 346	O 326	P 344	O 374	PK 812	K 712	P 572	PK 661	K 633	O 615	P 549	O 800
K 401	O 339	O 359	PK 338	P 358	K 393	O 367	K 367	K 767	O 598	O 618	PK 630	P 517	K 631	O 677	K 669
P 354	PK 347	K 378	P 356	PK 384	O 315	PK 368	P 397	P 694	PK 685	K 618	P 548	PK 661	O 587	PK 705	P 779

SYSTEM OF REPLICATION: 4 × 4 Latin Square, with plots sub-divided into 4.
AREA OF EACH WHOLE PLOT: 1/50th acre.
SOIL: Flinty loam on chalk.
VARIETY: Plumage Archer.
TREATMENTS:
O = No Nitrogen.
C = Cyanamide.
N = Nitrate of Soda
S = Sulphate of Ammonia
} At the rate of 0.2 cwt. N per acre.

Plan showing Nitrogenous Treatments applied to whole plots.

O	N	S	C
S	O	C	N
C	S	N	O
N	C	O	S

Plots sub-divided to receive no Potash or Superphosphate (O), Sulphate of Potash (K) at the rate of 0.6 cwt. K_2O per acre, Superphosphate (P) at the rate of 0.4 cwt. P_2O_5 per acre, and Sulphate of Potash and Superphosphate (PK).

Plots harvested by sampling method.

Manures applied: April 17th. Harvested: August 20th-21st.

Barley sown: April 17th. Previous crop: Oats and Vetches.

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Summary of Results.

Average yield	Cwt. per acre					Per cent.				
	No Nitrogen	Sulph./ Amm.	Nitrate of Soda	Cyana-mide	Mean	No Nitrogen	Sulph./ Amm.	Nitrate of Soda	Cyana-mide	Mean
Grain—										
No Potash or Super	15.6	17.8	16.9	17.0	16.8	90.6	103.5	98.6	99.1	97.9
Sulphate of Potash	17.1	17.7	17.2	17.6	17.4	99.6	103.0	100.4	102.8	101.5
Superphosphate ..	16.2	18.0	17.0	16.3	16.9	94.4	105.2	99.1	95.2	98.4
Potash and Super ..	16.9	17.9	17.5	17.8	17.5	98.6	104.1	102.1	103.6	102.1
Mean	16.4	17.8	17.2	17.2	17.2	95.8	104.0	100.0	100.2	100.0
Straw—										
No Potash or Super	26.8	29.6	28.9	28.2	28.4	94.8	104.7	102.0	99.8	100.3
Sulphate of Potash	25.8	28.1	31.2	28.9	28.5	91.3	99.4	110.4	102.0	100.8
Superphosphate ..	27.1	29.4	28.0	27.0	27.9	95.7	104.0	98.9	95.4	98.5
Potash and Super ..	24.9	29.6	30.1	29.1	28.4	88.0	104.6	106.3	102.9	100.4
Mean	26.2	29.2	29.6	28.3	28.3	92.4	103.2	104.4	100.0	100.0

Standard Errors : comparisons involving :	Grain. cwt. per acre.	Grain. per cent.	Straw. cwt. per acre.	Straw. per cent.
Subtreatments only, over a single main treatment	0.704	4.10	2.04	7.20
Subtreatments only, over all main treatments	0.352	2.05	1.02	3.60
Main treatments, over a single sub-treatment	0.789	4.60	2.04	7.22
Main treatments, over the mean of all sub-treatments	0.501	2.92	1.02	3.62

The straw, but not the grain, shows a significant response to nitrogen, without any difference between the different forms. The response of the grain to potash is not significant, and there are no superphosphate effects.

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Potatoes: Effect of Superphosphate and Sulphate of Ammonia. G. Major, Esq., Newton Farm, Wisbech—1931.

IV.	III.	II.	I.
—	—	—	10
0	2½	5	—
2½	—	10	5
—	0	—	—
—	10	—	2½
5	—	0	—
10	5	—	—
—	—	2½	0

SYSTEM OF REPLICATION: 4×4 Latin Square, with split plots.
AREA OF EACH WHOLE PLOT: 1/35th acre.
Soil: Deep silt.
Variety: Yorkshire King Edwards.
TREATMENTS: Superphosphate at the rate of 0, 2½, 5 and 10 cwt. per acre, and half of each plot received in addition 2 cwt. Sulphate of Ammonia per acre as single and double dressing. Double Sulphate of Ammonia is indicated by the treatment symbol occurring on that half.
All plots received 4 cwt. Sulphate of Potash and 2 cwt. Sulphate of Ammonia per acre.
Manures applied: April 14th.
Land dunged in autumn of 1930.
Potatoes planted: April 16th.
Potatoes lifted: September 22nd.
Previous crop: Wheat.

Actual weights in lb.

Column	Single Sulphate of Ammonia.				Double Sulphate of Ammonia.			
	0	2½	5	10	0	2½	5	10
I.	353	365	405	363	431	392	369	413
II.	332	351	389	385	348	377	333	355
III.	322	366	349	340	312	356	338	285
IV.	397	371	298	362	366	381	363	360

Summary of Results.

Average yield. (Clean Weights.)	Tons per acre.					Per Cent.				
	No Super.	2½ cwt. Super.	5 cwt. Super.	10 cwt. Super.	Mean.	No Super.	2½ cwt. Super.	5 cwt. Super.	10 cwt. Super.	Mean.
Single S/Amm. ..	10.97	11.35	11.26	11.33	11.23	97.4	100.8	100.0	100.6	99.7
Double S/Amm. ..	11.38	11.76	10.96	11.04	11.29	101.1	104.5	97.4	98.1	100.3
Mean	11.18	11.56	11.11	11.18	11.26	99.3	102.7	98.7	99.3	100.0

Standard Error of Single treatments = 0.386 or 3.43 per cent.
Standard Error Mean of Single and Double S/Amm. = 0.192 or 1.70 per cent.

No significant effects.

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Potatoes: Effect of Sulphate of Ammonia, Sulphate of Potash and Superphosphate.

A. W. Oldershaw, Esq., County Organiser, Tunstall, Suffolk, 1931.

N	NK	NPK	I.
ICI	NP	O	
O	NPK	NK	II.
ICI	NP	N	
N	NPK	NK	III.
NP	O	ICI	
NPK	NP	NK	IV.
O	ICI	N	
NPK	NK	O	V.
N	ICI	NP	
NP	O	NPK	VI.
N	ICI	NK	

System of Replication: 6 randomised blocks of 6 plots each.

Area of Each Plot: 1/85th acre.

Soil: Light sand, very poor.

Variety: Great Scott.

Treatments: I.C.I. complete Fertiliser and Sulphate of Ammonia at the rate of 0.6 cwt. N per acre, Sulphate of Potash at the rate of 1.21 cwt. K_2O per acre and Super at the rate of 0.63 cwt. P_2O_5 per acre. The I.C.I. fertiliser contained N, 10.3 per cent.; P_2O_5, 10.8 per cent.; K_2O, 20.7 per cent.

Blocks 1-3 are on chalked land, blocks 4-6 on unchalked land. The chalked area received 5 tons per acre of lump chalk during winter 1925-6.

Manures applied: April 21st.

Potatoes planted: April 22nd.

Potatoes lifted: October 7th.

Previous crop: Buck wheat.

Actual weights in lb.

Block.	O	N	NP	NK	NPK	I.C.I.
I.	177	286	311	280	312	331
II.	185	278	294	292	322	323
III.	182	258	266	284	319	313
IV.	172	257	297	219	289	334
V.	193	253	291	233	328	319
VI.	214	218	284	259	313	325

Summary of Results.

Average yield	No Nitrogen	S/Amm.	S/Amm. + S/Potash	S/Amm. + Super.	S/Amm. + Super. + S/Potash	I.C.I. Mixture	Mean	S. Error
Tons per acre ..	7.10	9.80	9.91	11.02	11.91	12.30	10.34	0.286
Per cent. ..	68.7	94.8	95.8	106.6	115.2	118.9	100.0	2.77

Definitely significant response to nitrogen. A significant improvement is produced by superphosphate. The difference between the I.C.I. mixture and the balanced dressing is not significant. The chalked half of the field has not given markedly different results from the unchalked.

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Potatoes: Effect of Sulphate of Ammonia, Sulphate of Potash, and Superphosphate.

H. Inskip, Esq., Stanford, Biggleswade, 1931.

C			A		
2S 1K —	— 2S 2K	— 1S 2K	— 2S 0K	0S 1K —	1S 1K —
1S 0K —	— 1S 1K	0S 0K —	— 0S 0K	— 1S 2K	— 1S 0K
2S 0K —	0S 1K —	0S 2K —	— 2S 2K	— 2S 1K	0S 2K —
— 0S 1K	— 0S 2K	2S 2K —	— 2S 0K	— 0S 1K	— 2S 2K
— 1S 2K	— 0S 0K	— 1S 0K	1S 2K —	— 2S 1K	0S 2K —
— 2S 1K	2S 0K —	1S 1K —	0S 0K —	1S 1K —	— 1S 0K
D			B		

SYSTEM OF REPLICATION: 4 randomised blocks, each of 9 plots. split for superphosphate.

AREA OF EACH PLOT; 1/100th acre.

Soil: Light gravel.

Variety: Arran Banner.

TREATMENTS: Sulphate of Ammonia (S) at the rate of 0.3 and 0.6 cwt. N per acre, Sulphate of Potash (K) at the rate of 0.75 and 1.5 cwt. K_2O per acre. Superphosphate at the rate of 0.4 cwt. P_2O_5 per acre applied to one out of each pair of sub-plots (indicated by the treatment symbol occurring on that half).

Manures applied: April 13th.

Potatoes planted: April 14th

Potatoes lifted: September 18th-19th.

Previous crop: Sprouts.

Actual weights in lb. (dirty)

Block.	With Superphosphate.								
	0-0	0-1	0-2	1-0	1-1	1-2	2-0	2-1	2-2
A	256	254	201	266	241	288	280	287	275
B	213	238	177	239	247	236	251	224	246
C	259	252	261	250	271	285	252	292	271
D	211	228	221	217	269	262	272	256	267
	Without Superphosphate.								
A	261	245	207	247	250	286	270	304	282
B	182	219	213	218	220	244	265	280	254
C	255	237	240	246	250	285	274	300	295
D	222	231	248	250	234	273	236	263	248

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Summary of Results.

Clean weights		Average yield tons per acre.				Average yield per cent.			
		No Potash.	Single Potash.	Double Potash.	Mean.	No Potash.	Single Potash.	Double Potash.	Mean.
Without Super	No S/Am.	9.81	9.94	9.68	9.81	91.8	92.9	90.6	91.8
	Single S/Am.	10.25	10.17	11.60	10.67	95.8	95.1	108.5	99.8
	Double S/Am.	11.14	12.23	11.50	11.63	104.2	114.4	107.6	108.7
	Mean	10.40	10.78	10.93	10.70	97.3	100.8	102.2	100.1
With Super	No S/Am.	10.01	10.36	9.17	9.85	93.6	96.9	85.8	92.1
	Single S/Am.	10.36	10.96	11.42	10.91	96.9	102.5	106.8	102.1
	Double S/Am.	11.25	11.29	11.29	11.28	105.2	105.6	105.6	105.5
	Mean	10.54	10.87	10.63	10.68	98.6	101.7	99.4	99.9

Standard Error = 0.336 tons or 3.14 per cent.

Mean of Superphosphate and No Superphosphate.

Clean weights	Average yield tons per acre.				Average yield per cent.			
	No Potash.	Single Potash.	Double Potash.	Mean.	No Potash.	Single Potash.	Double Potash.	Mean.
No S/Amm.	9.91	10.15	9.43	9.83	92.7	94.9	88.2	91.9
Single S/Amm.	10.31	10.57	11.51	10.80	96.4	98.8	107.7	101.0
Double S/Amm.	11.20	11.76	11.40	11.45	104.7	110.0	106.6	107.1

Standard Error = 0.259 tons or 2.42 per cent.

The response to sulphate of ammonia is definitely significant. There is a significant response to sulphate of potash in the presence of sulphate of ammonia. No response to superphosphate. The depression of yield shown by superphosphate at the higher levels of nitrogen and potash is not significant.

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Potatoes: Effect of Sulphate of Ammonia, Sulphate of Potash, and Superphosphate.

R. Starling, Esq., Northfield Farm, Little Downham, Ely, 1931.

C			A		
1P 2K —	1P 0K —	— 2P 0K	— 0P 0K	— 2P 1K	1P 1K —
— 0P 0K	— 2P 2K	— 0P 2K	2P 2K —	1P 2K —	— 1P 0K
— 0P 1K	2P 1K —	1P 1K —	— 2P 0K	— 0P 2K	— 0P 1K
— 1P 1K	2P 0K —	— 2P 2K	— 0P 1K	1P 0K —	— 2P 2K
0P 0K —	— 1P 2K	2P 1K —	1P 2K —	— 2P 1K	2P 0K —
0P 2K —	0P 1K —	— 1P 0K	— 1P 1K	— 0P 0K	— 0P 2K
D			B		

SYSTEM OF REPLICATION: 4 randomised blocks, each of 9 plots, split for Nitrogen.

AREA OF EACH SUB-PLOT: 1/100th acre.

Soil: Black Fen.

Variety: Majestic.

Potatoes planted: April 6th.

Potatoes lifted: October 7th-8th.

Previous crop: Oats.

TREATMENTS: Superphosphate (P) at the rate of 0, 5 and 10 cwt. per acre, Sulphate of Potash (K) at the rate of 0, 2 and 4 cwt. per acre. Sulphate of Ammonia at the rate of 0.4 cwt. N per acre, applied to one out of each pair of sub-plots indicated by the treatment symbol occurring on that half.

Manures applied: April 2nd.

Actual weights in lb.

Block.	With Sulphate of Ammonia.								
	0-0	0-1	0-2	1-0	1-1	1-2	2-0	2-1	2-2
A	175	173	239	205	232	230	224	277	229
B	203	167	170	256	224	208	243	283	252
C	213	217	189	261	201	256	266	254	284
D	144	160	163	210	223	207	258	241	238
	Without Sulphate of Ammonia.								
A	194	146	188	158	176	204	177	263	214
B	196	134	146	213	173	178	196	223	188
C	209	185	171	185	195	231	245	230	241
D	122	101	144	149	211	155	193	242	179

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Summary of Results.

		Average yield in tons per acre.				Average yield per cent.			
		No Super	Single Super	Double Super	Mean.	No Super.	Single Super.	Double Super.	Mean.
Without S/Amm.	No Potash	8.05	7.87	9.05	8.32	88.1	86.2	99.1	91.1
	Single Potash	6.32	8.43	10.69	8.48	69.2	92.3	117.1	92.8
	Double Potash	7.24	8.57	9.17	8.33	79.3	93.8	100.4	91.2
	Mean	7.20	8.29	9.64	8.38	78.9	90.8	105.5	91.7
With S/Amm.	No Potash	8.20	10.40	11.06	9.89	89.8	113.9	121.1	108.3
	Single Potash	8.00	9.82	11.77	9.87	87.6	107.5	128.9	108.0
	Double Potash	8.49	10.06	11.19	9.91	93.0	110.1	122.6	108.6
	Mean	8.23	10.09	11.34	9.89	90.1	110.5	124.2	108.3
Mean of no S/Amm. and S/Amm.		7.72	9.19	10.49	9.13	84.5	100.6	114.9	100.0
Standard Error = 0.512 tons or 5.61 per cent.									

The response to superphosphate and to sulphate of ammonia are definitely significant. The lower yields of the plots receiving potash only are statistically significant, and there is some evidence that the sulphate of ammonia is more effective in the presence of superphosphate.

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Potatoes: Effect of Sulphate of Potash and Superphosphate.

J. A. Tribe, Esq., Willow Farm, Nr. March, 1931.

N	O	N	O	O	N
0P 1K	2P 0K	0P 0K	1P 0K	1P 1K	2P 1K
1P 1K	0P 0K	2P 1K	2P 0K	1P 0K	0P 1K
1P 0K	0P 1K	2P 0K	2P 1K	0P 0K	1P 1K
2P 1K	1P 1K	1P 0K	0P 1K	2P 0K	0P 0K
2P 0K	2P 1K	1P 1K	0P 0K	0P 1K	1P 0K
0P 0K	1P 0K	0P 1K	1P 1K	2P 1K	2P 0K
1	2	3	4	5	6

SYSTEM OF REPLICATION: 6 × 6 Latin Square.
AREA OF EACH PLOT: 1/70th acre.
Soil: Poor Fenland.
Variety: Arran Chief.
TREATMENTS: Superphosphate (P) at the rate of 0, 5 and 10 cwt. per acre, Sulphate of Potash (K) at the rate of 0 and 2 cwt. per acre, Sulphate of Ammonia at the rate of 0.4 cwt. N per acre.
Manures applied: April 9th.
Potatoes planted: April 13th.
Potatoes lifted: October 22nd.
Previous crop: Wheat.

Actual weights in lb.

Column.		0-0	0-1	1-0	1-1	2-0	2-1
1 and 2	No Nitrogen ..	134	155	228	184	187	233
	Nitrogen	196	186	198	213	245	233
3 and 4	No Nitrogen ..	248	234	222	255	265	290
	Nitrogen	208	242	218	282	272	296
5 and 6	No Nitrogen ..	261	247	250	296	248	273
	Nitrogen	239	253	303	310	294	331

Summary of Results.

Average yield corrected for dirt tare.	Tons per acre.				Per cent.			
	No Super.	Single Super.	Double Super.	Mean.	No Super.	Single Super.	Double Super.	Mean.
No Potash ..	6.38	7.04	7.50	6.97	88.4	97.5	103.9	96.6
Potash	6.53	7.64	8.21	7.46	90.5	105.8	113.8	103.4
Mean	6.46	7.34	7.85	7.22	89.5	101.7	108.8	100.0

Standard Error Means of No Nitrogen and Nitrogen = 0.234 or 3.24 per cent.

The improvement due to superphosphate is definitely significant, both with and without potash. Potash produces a significant effect at all levels of superphosphate. The direct effect of nitrogen is not significant, this comparison being based on only three replications.

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Potatoes: Effect of Nitrate of Soda in various dressings.

T. H. Ream, Esq., Portobello Farm, Nr. Potton, 1931.

In co-operation with R. S. Brieant, Esq.

I.	E	A	D	C	B
II.	D	E	C	B	A
III.	C	B	A	D	E
IV.	A	D	B	E	C
V.	B	C	E	A	D

SYSTEM OF REPLICATION: 5×5 Latin Square.
AREA OF EACH PLOT: 1/50th acre.
Variety: Ninetyfold.
Soil: Very poor light sand on "Sandy Heath."
TREATMENTS:
A=No Nitrate of Soda.
B=1 cwt. Nitrate before sowing and 1 cwt. top dressed.
C=2 cwt. Nitrate before sowing.
D=3 cwt. Nitrate before sowing.
E=2 cwt. Nitrate before sowing and 1 cwt. top dressed.
Basal manuring: 3 cwt. Superphosphate and 3 cwt. Sulphate of Potash per acre.
Manures applied: March 25th.
Potatoes planted: April 6th.
Potatoes lifted: July 6th.
Previous crop: Dunged early potatoes followed by sprouts.

Actual weights in lb. (Ware).

Row.	A	B	C	D	E
I.	164	200	196	191	172
II. ..	214	227	192	174	194
III. ..	220	200	174	256	261
IV. ..	186	247	264	203	254
V. ..	228	204	185	256	210

Summary of Results.

Average Yield	No Nitrate of Soda	1 cwt. Nitrate before sowing + 1 cwt. T.D.	2 cwt. Nitrate before sowing	3 cwt. Nitrate before sowing	2 cwt. Nitrate before sowing + 1 cwt. T.D.	Mean	Standard Error
Tons per acre	4.52	4.81	4.51	4.82	4.87	4.71	0.120
Per cent.	96.0	102.2	95.9	102.4	103.5	100.0	2.54

The response to Nitrate of Soda is not significant.

N

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Potatoes: Effect of Superphosphate.

Comparison of Nitrate of Soda and Sulphate of Ammonia.

T. H. Ream, Esq., Portobello Farm, Nr. Potton, 1931.

IV.	III.	II.	I.
— / 0	4 / —	— / 8	2 / —
— / 2	8 / —	— / 4	— / 0
— / 8	2 / —	0 / —	4 / —
— / 4	0 / —	2 / —	8 / —

SYSTEM OF REPLICATION: 4 × 4 Latin Square with split plots.

AREA OF EACH WHOLE PLOT: 1/30th acre.

Soil: Very poor light sand on "Sandy Heath."

Variety: Ninetyfold.

TREATMENTS: Superphosphate at the rate of 0, 2, 4 and 8 cwt. per acre. Half of each plot received Sulphate of Ammonia and the other half received Nitrate of Soda. Nitrate of Soda equivalent to Sulphate of Ammonia. Sulphate of Ammonia at the rate of 2 cwt. per acre. Nitrate of Soda is indicated by the treatment symbol occurring on that half.

Basal Manuring: 2 cwt. Sulphate of Potash per acre.

Potatoes planted: April 6th.

Potatoes lifted: July 6th.

Previous crop: Dunged early potatoes, followed by sprouts.

Actual Weights in lb. (Ware).

Column	Nitrate of Soda.				Sulphate of Ammonia.			
	O	2	4	8	0	2	4	8
I.	153	143	163	129	131	127	147	126
II.	162	148	167	137	147	135	157	156
III.	152	160	164	178	139	153	163	154
IV.	161	156	176	145	164	135	146	123

Summary of Results.

Average yield.	No Super.	2 cwt. Super.	4 cwt. Super.	8 cwt. Super.	Mean.	Standard Error.
Tons per acre—						
S/Ammonia	3.89	3.68	4.10	3.74	3.86	} 0.125
N/Soda	4.21	4.06	4.49	3.94	4.18	
Mean	4.05	3.87	4.30	3.84	4.02	0.124
Per cent.—						
S/Ammonia	96.9	91.7	102.2	93.2	96.0	} 3.11
N/Soda	104.7	101.2	111.7	98.2	104.0	
Mean	100.8	96.5	107.0	95.7	100.0	3.09

Nitrate of Soda significantly superior to Sulphate of Ammonia. No response to Superphosphate.

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Sugar Beet: Effect of Potash Salt, Superphosphate, and Sulphate of Ammonia.

R. Starling, Esq., Northfield Farm, Little Downham, Ely, 1931.

C			A		
—	2P	1P	—	—	0P
—	1K	1K	—	—	1K
2P	—	—	1P	2P	—
2K	—	—	2K	2K	—
1P	—	—	—	—	—
2K	—	—	—	—	—
—	1P	0P	0P	1P	2P
—	0K	0K	2K	1K	1K
—	0P	0P	1P	0P	2P
—	1K	2K	0K	0K	0K
2P	—	—	—	—	—
0K	—	—	—	—	—
1P	—	—	0P	2P	—
1K	—	—	2K	0K	—
—	0P	1P	—	—	0P
—	2K	2K	—	—	1K
—	—	1P	2P	1P	—
—	—	0K	2K	1K	—
2P	2P	—	—	—	0P
1K	0K	—	—	—	0K
—	—	—	2P	1P	—
—	—	—	1K	2K	—
0P	0P	2P	—	—	1P
1K	0K	2K	—	—	0K
D			B		

SYSTEM OF REPLICATION : 4 randomised blocks, each of 9 plots, split for nitrogen.

AREA OF EACH WHOLE PLOT : 1/50th acre.

Soil : Good black fen near the clay.

Variety : Kleinwanzleben E.

Manures applied : April 15th.

Beet sown : April 15th.

Beet lifted : November 5th-6th.

TREATMENTS : Superphosphate (P) at the rate of 0, 3 and 6 cwt. per acre, Potash Salt (K) at the rate of 0, 1½ and 3 cwt. per acre. Sulphate of Ammonia at the rate of 2 cwt. per acre, applied to one out of each pair of sub-plots, indicated by the treatment symbol occurring on that half.

Previous crop : Oats, not dunged:

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Actual weights in lb.

Block.	0-0	0-1	0-2	1-0	1-1	1-2	2-0	2-1	2-2
Roots (unwashed)—	Without Sulphate of Ammonia.								
A	374	371	378	388	375	386	367	385	372
B	375	379	382	378	371	367	391	403	378
C	411	381	407	381	407	377	376	394	380
D	360	370	370	423	388	408	373	365	402
	With Sulphate of Ammonia.								
A	370	384	395	397	400	385	398	380	399
B	384	392	402	361	387	375	388	411	394
C	390	388	404	385	398	379	391	395	389
D	393	379	372	418	382	404	370	383	413
Tops*—	Without Sulphate of Ammonia.								
A	266	274	268	292	253	264	265	244	251
B	265	183	311	264	287	300	242	274	324
	With Sulphate of Ammonia.								
A	290	230	291	260	274	307	246	258	272
B	312	260	287	292	296	303	267	258	297
Sugar percentage—	Without Sulphate of Ammonia.								
A	17.48	18.30	17.31	17.54	17.48	17.48	18.41	17.48	18.30
B	16.33	18.81	17.43	16.62	17.48	17.48	17.48	16.56	16.50
C	16.50	18.52	18.30	17.42	17.65	17.36	17.36	17.77	18.35
D	18.05	16.45	18.75	17.01	16.84	18.18	17.01	17.43	18.30
	With Sulphate of Ammonia.								
A	16.78	17.70	16.42	16.76	16.93	16.96	17.31	18.25	18.30
B	16.73	17.43	16.44	17.36	16.44	16.96	18.05	17.88	16.16
C	16.21	16.79	16.90	17.54	17.88	16.76	17.59	17.54	18.11
D	17.48	17.25	17.70	16.33	18.86	16.73	17.82	15.86	16.84

* Tops weighed on Block A and B only, on area of half plot = 1/100th acre.

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Summary of Results.

Average yield.		Tons per acre.				Per cent.			
		No Super.	Single Super.	Double Super.	Mean.	No Super.	Single Super.	Double Super.	Mean.
Roots— (washed) Without S/Amm.	No Potash Salt	15.35	15.86	15.23	15.48	98.3	101.6	97.5	99.1
	Single Potash Salt	15.16	15.57	15.62	15.45	97.1	99.7	100.1	98.9
	Double Potash Salt	15.52	15.53	15.48	15.52	99.4	99.5	99.1	99.3
	Mean	15.35	15.66	15.44	15.48	98.3	100.2	98.9	99.1
With S/Amm.	No Potash Salt	15.52	15.77	15.62	15.64	99.4	101.0	100.1	100.2
	Single Potash Salt	15.59	15.83	15.85	15.76	99.8	101.4	101.5	100.9
	Double Potash Salt	15.90	15.59	16.11	15.87	101.7	99.8	103.2	101.6
	Mean	15.67	15.73	15.87	15.75	100.3	100.7	101.6	100.9
Mean of No S/Amm. & S/Amm.		15.51	15.70	15.65	15.62	99.3	100.5	100.2	100.0
Tops— Without S/Amm.	No Potash Salt	23.70	24.82	22.63	23.72	97.3	101.8	92.9	97.3
	Single Potash Salt	20.40	24.11	23.12	22.54	83.7	98.9	94.9	92.5
	Double Potash Salt	25.85	25.18	25.67	25.56	106.0	103.3	105.3	104.9
	Mean	23.32	24.70	23.81	23.94	95.7	101.4	97.7	98.2
With S/Amm.	No Potash Salt..	26.87	24.64	22.90	24.81	110.3	101.1	94.0	101.8
	Single Potash Salt	21.87	25.45	23.04	23.45	89.8	104.4	94.5	96.2
	Double Potash Salt	25.80	27.23	25.40	26.14	105.9	111.7	104.2	107.3
	Mean	24.85	25.77	23.78	24.80	102.0	105.7	97.6	101.8
Mean of No S/Amm. & S/Amm.		24.08	25.24	23.79	24.37	98.8	103.6	97.6	100.0
Sugar Percentage in Roots— Without S/Amm.	No Potash Salt	17.09	17.15	17.56					
	Single Potash Salt	18.02	17.36	17.31	17.55				
	Double Potash Salt	17.95	17.62	17.86					
With S/Amm.	No Potash Salt	16.80	17.00	17.69					
	Single Potash Salt	17.29	17.53	17.38	17.19				
	Double Potash Salt	16.86	16.85	17.35					

Standard Error : Roots : 0.304 tons or 1.95 per cent.
,, ,, Tops : 1.576 tons or 6.47 per cent.
,, ,, Sugar percentage : 0.348.

The roots show a small but definitely significant response to nitrogen. For the tops the difference, though greater, is not significant owing to the higher standard error. The sugar percentage is significantly depressed by nitrogen. There are no other significant effects.

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Sugar Beet: Effect of Potash Salt and Superphosphate.

J. A. Tribe, Esq., Willow Farm, Nr. March, 1931.

	O	N	O	N	N	O
I.	0P 0K	2P 0K	1P 1K	2P 1K	0P 1K	1P 0K
II.	1P 0K	0P 1K	2P 0K	0P 0K	1P 1K	2P 1K
III.	1P 1K	1P 0K	0P 0K	2P 0K	2P 1K	0P 1K
IV.	2P 0K	2P 1K	0P 1K	1P 1K	1P 0K	0P 0K
V.	2P 1K	1P 1K	1P 0K	0P 1K	0P 0K	2P 0K
VI.	0P 1K	0P 0K	2P 1K	1P 0K	2P 0K	1P 1K

SYSTEM OF REPLICATION: 6×6 Latin Square.
AREA OF EACH PLOT: 1/60th acre.
Soil: Black Fen, about 1-1½ ft. deep, on clay.
Variety: Shrciber.
TREATMENTS: Superphosphate (P) at the rate of 0, 3 and 6 cwt. per acre, Potash Salt (K) at the rate of 0 and 2½ cwt. per acre, and Sulphate of Ammonia at the rate of 0·4 cwt. N. per acre.
Manures applied: April 23rd.
Beet drilled: May 6th.
Beet lifted: December 7th.
Previous crop: Beet.

Actual weights in lb.

Row.	Roots (unwashed).						Tops.					
	0-0	0-1	1-0	1-1	2-0	2-1	0-0	0-1	1-0	1-1	2-0	2-1
I.	385	329	348	415	383*	388	126	143	96	137	172*	133
II.	425	396*	408	428	389	502	159	191*	138	141	156	163
III.	289	414	382*	446	441	438	153	136	173*	144	174	173
IV.	447	386	454	447	466	375	117	134	145	130	164	155
V.	432	433	431	501	499	503	146	132	121	186	141	178
VI.	477	451	442*	454	452	432*	195	182	132*	115	136	157*

*These plots discarded and values calculated from the remaining plots. Tops were weighed on ½ plots only. Area 1/240th acre.

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Summary of Results.

Roots (unwashed)—	Average yield tons per acre. Nitrogen and No Nitrogen.				Average yield per cent. Nitrogen and No Nitrogen.			
	No Super.	Single Super.	Double Super.	Mean.	No Super.	Single Super.	Double Super.	Mean.
No Potash ..	10.96	11.00	11.74	11.24	96.4	96.7	103.2	98.8
Potash	10.75	12.01	11.78	11.51	94.5	105.6	103.5	101.2
Mean	10.86	11.51	11.76	11.38	95.4	101.2	103.4	100.0
Tops—								
No Potash ..	16.00	14.37	16.84	15.74	100.0	89.9	105.3	98.4
Potash	16.39	15.23	17.12	16.25	102.5	95.2	107.1	101.6
Mean	16.20	14.80	16.98	15.99	101.3	92.6	106.2	100.0

Standard Error : Roots : 0.434 tons or 3.82 per cent.
,, ,, Tops : 0.757 tons or 4.73 per cent.

Roots.	tons per acre.	per cent.
Nitrogen ..	11.34	99.7
No Nitrogen ..	11.41	100.3
Mean	11.38	100.0
Tops—		
Nitrogen ..	16.76	104.8
No Nitrogen ..	15.23	95.2
Mean	15.99	100.0

The effect of superphosphate is not significant. There is no evidence of any potash or nitrogen effects. The experiment was marred by the acidity of certain plots.

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Sugar Beet: Effect of Sulphate of Ammonia and Superphosphate.

Messrs. C. S. & G. M. Wilson, Stanway Hall Farm, Colchester, 1931.

A			B		
1P 1S	2P 0S	0P 0S	0P 1S	1P 0S	0P 2S
0P 1S	1P 2S	2P 2S	1P 2S	2P 0S	1P 1S
0P 2S	2P 1S	1P 0S	2P 2S	2P 1S	0P 0S
0P 0S	0P 2S	1P 2S	0P 1S	2P 1S	0P 2S
2P 2S	2P 0S	1P 1S	2P 2S	1P 0S	0P 0S
1P 0S	2P 1S	0P 1S	2P 0S	1P 1S	1P 2S
C			D		

SYSTEM OF REPLICATION: 4 randomised blocks of 9 plots each.

AREA OF EACH PLOT: 1/60th acre.

Soil: Light sandy gravel.

Variety: Kleinwanzleben

TREATMENTS: Superphosphate (P) at the rate of 0, 2 and 4 cwt. per acre, Sulphate of Ammonia (S) at the rate of 0, 1½ and 3 cwt. per acre.

All plots received 30 per cent. Potash Salt at the rate of 2½ cwt. per acre, and dung, 8 loads per acre.

Manures applied: April 28th.

Beet planted: April 28th.

Beet lifted: November 2nd-4th.

Previous crop: Barley.

Actual weights in lb.

Block.		0-0	0-1	0-2	1-0	1-1	1-2	2-0	2-1	2-2
Roots (unwashed)	A	325	440	463	367	428	424	338	443	460
	B	349	394	334	402	409	459	426	486	458
	C	458	409	447	406	461	454	392	471	471
	D	424	460	444	449	485	498	366	499	477
Tops	A	213	279	360	215	286	327	211	288	310
	B	291	299	396	337	320	381	303	385	400
	C	279	299	390	230	318	372	278	317	367
	D	260	330	421	293	381	431	240	395	367
Sugar percentage	A	19.45	19.92	19.46	19.92	19.68	19.17	19.74	19.92	19.23
	B	19.34	19.00	18.76	19.05	19.28	19.86	19.35	19.51	19.92
	C	19.57	18.64	19.40	19.05	18.76	19.11	19.40	19.12	19.28
	D	19.34	19.74	18.82	18.93	18.47	18.36	19.12	19.05	18.93

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Summary of Results.

Average yield. Roots (clean)—	Tons per acre.				Per cent.			
	No Super.	Single Super.	Double Super.	Mean.	No Super.	Single Super.	Double Super.	Mean.
No S/Amm. ..	9.26	9.66	9.05	9.33	90.5	94.4	88.5	91.1
Single S/Amm.	10.13	10.61	11.30	10.68	99.0	103.7	110.4	104.4
Double S/Amm.	10.04	10.92	11.10	10.69	98.2	106.7	108.5	104.5
Mean	9.81	10.39	10.48	10.22	95.9	101.6	102.5	100.0
Tops—								
No S/Amm. ..	6.98	7.20	6.91	7.03	81.1	83.6	80.3	81.7
Single S/Amm. ..	8.08	8.74	9.27	8.70	93.9	101.5	107.7	101.0
Double S/Amm.	10.49	10.12	9.67	10.09	121.9	117.5	112.3	117.3
Mean	8.52	8.68	8.62	8.61	99.0	100.9	100.1	100.0
Sugar percentage—								
No S/Amm. ..	19.42	19.24	19.40	19.36				
Single S/Amm. ..	19.32	19.05	19.40	19.26				
Double S/Amm.	19.11	19.12	19.34	19.19				
Mean	19.29	19.14	19.38	19.27				

Standard Errors : Roots Single treatments : 0.402 tons or 3.92 per cent.
,, Means : 0.232 tons or 2.27 per cent.
Tops Single treatments : 0.330 tons or 3.83 per cent.
,, Means : 0.190 tons or 2.21 per cent.
Sugar percentage Single treatments : 0.187
Means : 0.108.

Definitely significant response to the single dressing of sulphate of ammonia, both for roots and tops, with a further significant response of the tops to the double dressing but no further improvement of the roots. The response to superphosphate for the roots is not significant, and there is no sign of any effect on the tops. No significant effects on sugar percentage.

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Experiments at other centres, carried out by the local workers on the lines of those described on the preceding pages.

Potatoes. J. E. Arden, Esq., Owmby Cliff, Lincolnshire, 1931. J. A. McVicar, Esq., County Organiser.

4 × 4 Latin Square : Plots 1/80th acre. Soil : Limestone.
Basal Manuring : Dung ; 3 cwt. Sulphate of Potash and 4 cwt. Sulphate of Ammonia per acre.
Variety : King Edward. Potatoes planted : April 15th. Lifted : October 6th.
Previous crop : 1 year seeds.

Average yield.	No Super.	2 cwt. Super.	4 cwt. Super.	8 cwt. Super.	Mean.	Standard Error.
Tons per acre	7.01	6.83	6.97	6.60	6.85	0.187
Per cent.	102.3	99.7	101.8	96.3	100.0	2.73

No apparent manurial effects.

Potatoes. Midland Agricultural College, Loughborough, 1931.

4 × 4 Latin Square : Plots 1/60th acre. Soil : Light loam.
TREATMENTS : Fish Manure, I.C.I. Compound Manure, Home-made mixture at the rate of 0.83 cwt. N, 0.83 cwt. P_2O_5, and 1.66 cwt. K_2O per acre.
Variety : King Edward. Potatoes planted : April 17th. Lifted : September 26th.
Previous crop : Seeds hay.

Average Yield.	No Manure	Fish Manure.	I.C.I. Compound Manure.	Home-made Mixture.	Mean.	Standard Error.
Tons per acre	5.68	7.85	8.71	8.26	7.62	0.221
Per cent...	74.5	103.0	114.2	108.3	100.0	2.90

The response to the manures is definitely significant. There is a significant difference between I.C.I. and fish manure, but not between I.C.I. and home-made, or home-made and fish manure. Neither is the difference between the inorganic (taken together) and the fish manures significant.

Potatoes. Midland Agricultural College, Loughborough, 1931.

4 Randomised blocks of 9 plots each. Plots 1/48.8 acre. Soil : Light loam.
TREATMENTS : Sulphate of Ammonia and Sulphate of Potash at the rate of 1½ and 3 cwt. per acre.
Basal Manuring : 3 cwt. Superphosphate per acre. No dung given.
Variety : King Edward. Potatoes planted : April 15th. Lifted : September 24th.
Previous crop : Seeds hay.

Average yield.	tons per acre.			per cent.		
	No Nitrogen.	Single S/Amm.	Double S/Amm.	No Nitrogen.	Single S/Amm.	Double S/Amm.
No Potash	7.55	8.58	10.33	87.0	98.9	119.0
Single Potash	7.86	8.35	9.73	90.6	96.3	112.1
Double Potash ..	7.02	8.69	9.99	80.9	100.1	115.2
Mean	7.48	8.54	10.02	86.2	98.4	115.4
Mean		8.68			100.0	
Standard Error (Single treatments)		0.455			5.24	
,, ,, (means)		0.263			3.02	

The response to Sulphate of Ammonia is definitely significant, the yield being proportional to the quantity of nitrogen supplied. No response to potash.

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Potatoes. County School, Welshpool, Montgomeryshire, 1931.

4 Randomised blocks of 4 plots each. Plots 0.00468 acre. Soil: Medium loam (Wenlock shale).
TREATMENTS: Sulphate of Ammonia, Nitrate of Soda and Cyanamide at the rate of 0.6 cwt. N. per acre.
Basal Manuring: 4 cwt. Superphosphate and 3 cwt. Sulphate of Potash per acre.
Variety: Great Scot. Potatoes planted: May 10th. Lifted: September 22nd-25th.
Previous crop: Potatoes.

Average yield.	No Nitrogen.	Cyana-mide.	Nitrate of Soda.	Sulphate of Amm.	Mean.	Standard Error.
Tons per acre	4.75	7.23	7.49	7.92	6.84	0.323
Per cent...	69.3	105.6	109.4	115.7	100.0	4.72

Definitely significant response to nitrogen. No significant difference between types of nitrogen.

Potatoes. Grammar School, Burford, Oxon, 1931.

2 unequal Randomised blocks of 4 and 12 plots each respectively, with split plots. Sub-plots: 1/200th acre. Soil: Limestone loam.
TREATMENTS: Main Tests, Superphosphate at the rate of 0, 0.3, 0.6, 1.2 cwt. P_2O_5 per acre. Sub-plots: Sulphate of Ammonia and Cyanamide at the rate of 0.6 cwt. **N.** per acre.
Basal Manuring: Sulphate of Potash at the rate of 1.4 cwt. K_2O per acre.
Variety: King George. Potatoes planted: April 27th. Lifted: October 1st.

Average Yield.	Tons per acre.					Per cent.				
	No Super.	2 cwt. Super.	4 cwt. Super.	8 cwt. Super.	Mean.	No Super.	2 cwt. Super.	4 cwt. Super.	8 cwt. Super.	Mean.
With S/Amm. ..	3.93	5.45	5.89	5.60	5.22	75.6	104.8	113.4	107.8	100.4
With Cyanamide ..	4.33	5.98	5.40	4.98	5.17	83.4	115.1	104.0	95.8	99.6
Mean	4.13	5.71	5.65	5.29	5.20	79.5	110.0	108.7	101.8	100.0

Standard Error single treatment: 0.431 tons or 8.30 per cent.
Standard Error Mean of S/Amm. and Cyan. = 0.353 tons or 6.80 per cent.
Standard Error Mean of all levels of Super. = 0.176 tons or 3.40 per cent.

There is a significant response to the 2 cwt. dressing of superphosphate, but no additional response to the heavier dressings. There are no significant differences between Sulphate of Ammonia and Cyanamide.

Potatoes. Sailors' Orphan Homes School, Hull, 1931.

4 × 4 Latin Square. Plots 0.00459 acre. Soil: Heavy alluvium.
TREATMENTS: Sulphate of Ammonia, Nitrate of Soda and Cyanamide at the rate of 0.6 cwt. N per acre.
Basal Dressing: 4 cwt. Superphosphate, 3 cwt. Sulphate of Potash per acre.
Variety: Kerr's Pink. Potatoes planted: April 29th. Lifted: Oct. 3rd-7th.

Average yield.	No Nitrogen.	Nitrate of Soda.	Sulphate of Ammonia.	Cyana-mide.*	Mean.	Standard Error.
Tons per acre	7.88	8.46	9.42	7.73	8.37	0.483
Per cent...	94.1	101.1	112.5	92.3	100.0	5.77

The response to treatments is not large enough to be significant.

* One plot of this treatment discarded and a value calculated for it from the remaining plots.

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Potatoes: Messrs. Hickman & Co., Wisbech, 1931.
W. F. Cheal, Esq., Horticultural Organiser.

4×4 Latin Square. Plots 0.0207 acre. Soil: Deep silt.
Basal Manuring: 4 cwt. Sulphate of Potash, 4 cwt. Sulphate of Ammonia per acre.
Variety: Baron. Potatoes planted: April 25th. Lifted:
Previous crop - Rhubarb.

Average Yield.	No Super.	2 cwt. Super.	4 cwt. Super.	8 cwt. Super.	Mean.	Standard Error.
Tons per acre ..	12.30	13.16	13.08	13.03	12.90	0.271
Per cent.	95.4	102.1	101.5	101.1	100.0	2.099

The effect of Superphosphate is just significant. No further response to the higher levels of Superphosphate.

Potatoes. Lady Manner's School, Bakewell, 1931.

4×4 Latin Square. Plots 1/120th acre. Soil: Limestone—rather stony.
TREATMENTS: Sulphate of Ammonia, Nitrate of Soda and Cyanamide at the rate of 0.6 cwt. N per acre.
Basal Manuring: 4 cwt. Superphosphate, 3 cwt. Sulphate of Potash per acre.
Variety: King Edward. Potatoes planted: May 8th. Lifted: Sept. 22nd-28th.

Average Yield.	No Nitrogen.	Sulphate of Ammonia.	Cyanamide	Nitrate of Soda.	Mean.	Standard Error.
Tons per acre ..	6.64	8.29	8.04	8.42	7.84	0.196
Per cent.	84.6	105.6	102.4	107.3	100.0	2.50

Definitely significant response to nitrogen. No significant differences between the various forms.

Potatoes: T. Gornall, Esq., Upper Birks Farm, Garstang, Lancs., 1931
J. J. Green, Esq., Director of Agriculture.

4×4 Latin Square. Plots 1/57th acre. Soil: Moss.
Basal Manuring: Sulphate of Ammonia and Sulphate of Potash each at the rate of 2 cwt. per acre, and 10 tons farmyard manure per acre.
Variety: King Edward VII. Potatoes planted: May 11th. Lifted: Sept. 22nd.
Previous crop: Spring oats.

Average Yield.	No Super.	2 cwt. Super.	4 cwt. Super.	8 cwt. Super.	Mean.	Standard Error.
Tons per acre ..	2.69	2.67	2.69	2.60	2.66	0.078
Per cent.	101.0	100.3	101.0	97.7	100.0	2.95

Partial failure of crop; no response to manurial treatment.

Potatoes. J. B. Everatt, Esq., Garthorpe, Lincs., 1931.
J. A. McVicar, Esq., County Organiser.

4×4 Latin Square. Plots 1/80th acre. Soil: Warp.
Basal Manuring: Sulphate of Ammonia and Superphosphate, each at the rate of 4 cwt. per acre.
Variety: King Edward. Potatoes planted: May 4th. Lifted: Oct. 15th.
Previous crop: Sugar Beet.

Average Yield.	No Sul. of Pot.	1 cwt. Sul. of Pot.	2 cwt. Sul. of Pot.	3 cwt. Sul. of Pot.	Mean.	Standard Error.
Tons per acre ..	11.88	12.39	12.84	12.30	12.35	0.350
Per cent.	96.1	100.3	103.9	99.6	100.0	2.83

No significant manurial effects.

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Potatoes. J. W. Halkon, Esq., Garthorpe, Lincs., 1931. J. A. McVicar, Esq., County Organiser.

4×4 Latin Square. Plots 1/80th acre. Soil: Warp.
Basal Manuring: Sulphate of Ammonia and Superphosphate, each at the rate of 4 cwt. per acre.
Variety: Majestic. Potatoes planted: April 15th. Lifted: Oct. 6th.
Previous crop: Peas.

Average Yield.	No Sul. of Pot.	1 cwt. Sul. of Pot.	2 cwt. Sul. of Pot.	3 cwt. Sul. of Pot.	Mean.	Standard Error.
Tons per acre ..	10.12	10.54	10.29	10.21	10.29	0.312
Per cent.	98.4	102.4	100.0	99.2	100.0	3.04

No apparent manurial effects.

Sugar Beet. South-Eastern Agricultural College, Wye, Kent, 1931.

4×4 Latin Square. Plots 1/40th acre. Soil: Silty loam.
TREATMENTS: Muriate of Potash, at the rate of 1.6 cwt. per acre, and Salt at the rate of 1.14 cwt. per acre.
Basal Manuring: 12 tons dung, Sulphate of Ammonia at the rate of 2 cwt. per acre, and Superphosphate at the rate of 4 cwt. per acre.
Variety: Kleinwanzleben E. Beet sown: May 6th. Lifted: Oct. 13th.
Previous crop: Oats.

Average yield.	No Potash.	Muriate of Potash.	Salt.	Muriate of Potash and Salt.	Mean.	Standard Error.
Roots (clean) tons per acre ..	11.18	10.82	11.31	11.12	11.11	0.169
per cent.	100.7	97.4	101.8	100.1	100.0	1.53
Sugar percentage in Roots	18.43	18.68	18.63	18.99	18.68	0.146

No significant effects. The difference of sugar percentage for the various treatments is not significant.

Sugar Beet. South-Eastern Agricultural College, Wye, Kent, 1931.

4×4 Latin Square. Plots 1/40th acre. Soil: Silty loam.
TREATMENTS: Sulphate of Ammonia at the rate of 1.33 cwt. per acre, Nitrate of Soda at the rate of 2.06 cwt. per acre, and Cyanamide at the rate of 1.6 cwt. per acre.
Basal Manuring: 12 tons dung, 4 cwt. Superphosphate, and 2 cwt. Muriate of Potash per acre.
Variety: Kleinwanzleben E. Beet sown: May 6th. Lifted: October 13th.
Previous crop: Oats.

Average Yield.	No Nitrogen.	Sulphate of Ammonia.	Cyana-mide.	Nitrate of Soda.	Mean.	Standard Error.
Roots (clean) Tons per acre ..	11.79	11.89	11.77	11.85	11.83	0.145
Per cent.	99.7	100.6	99.5	100.2	100.0	1.22
Tops Tons per acre ..	12.89	13.63	14.13	14.94	13.90	0.452
Per cent.	92.8	98.1	101.7	107.5	100.0	3.25
Sugar Percentage in Roots	18.93	18.48	18.61	18.39	18.60	0.0872

There is a significant improvement due to nitrogen in the yield of the tops, but no significant difference between the different kinds of nitrogen. The roots did not respond to treatment. Significant depression in sugar percentage by nitrogen, but no significant difference between the various forms of nitrogen.

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Sugar Beet. The University of Leeds, Askham Bryan, Yorks, 1931.

4 × 4 Latin Square. Plots 1/80th acre. Soil: Medium loam on gravel.
TREATMENTS: 2 cwt. Sulphate of Ammonia per acre with seed, Nitrate of Soda with seed, and Nitrate of Soda as top dressing equivalent to 2 cwt. Sulphate of Ammonia.
Basal Manuring: 10 tons Farmyard Manure, 2 cwt. Superphosphate, 1 cwt. Steamed Bone Flour, and 1 cwt. 30 per cent. Potash Salt per acre.
Variety: Kleinwanzleben E. Beet sown: May 6th. Lifted: October 30th.
Previous crop: Oats.

Average yield.	No Nitrogen.	Sulphate of Ammonia.	Nitrate of Soda with seed.	Nitrate of Soda top-dressing.	Mean.	Standard Error.
Roots (clean)—						
Tons per acre ..	7.93	9.04	9.27	9.05	8.82	0.250
Per cent.	89.8	102.5	105.0	102.6	100.0	2.84
Tops—						
Tons per acre	9.78	11.43	11.97	11.41	11.15	0.448
Per cent.	87.8	102.5	107.4	102.3	100.0	4.02
Sugar percentage in Roots	16.90	16.58	16.78	16.78	16.76	0.195

Significant response to nitrogen. The difference between the different forms of nitrogen is not significant. No significant differences in sugar percentage.

Sugar Beet. Gregory's Farm, Watton, 1931.

H. W. Gardner, Esq., Hertfordshire Farm Institute.

4 × 4 Latin Square. Plots 0.0223 acre. Soil: Gravelly—rather sour.
TREATMENTS: Dung and Sulphate of Ammonia 2 cwt. per acre, Superphosphate 3.57 cwt. per acre, Potash Salt (30 per cent.) at the rate of 2 cwt. per acre. Lime at the rate of 2 tons per acre, Cyanamide at the rate of 2 cwt. per acre and Slag (14 per cent.) at the rate of 3 cwt. per acre.
Variety: Kleinwanzleben E. Beet sown: May 1st. Lifted: September 12th.
Previous crop: Turnips.

Average yield.	Dung only	Dung, S/Amm., Super and Potash Salts.	Dung, S/Amm., Super, Potash Salts and Lime.	Dung, Cyanamide Slag and Potash Salts.	Mean.	Standard Error.
Roots (dirty)—						
Tons per acre ..	10.04	11.39	12.15	11.37	11.24	0.328
Per cent.	89.4	101.3	108.1	101.2	100.0	2.92
Tops—						
Tons per acre ..	9.57	10.86	12.21	11.27	10.98	0.407
Per cent.	87.2	98.9	111.2	102.7	100.0	3.71

Significant improvement by artificials, with further significant improvement by lime. No appreciable difference between sulphate of ammonia and super, and cyanamide and slag.

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Swedes. County School, Welshpool, Montgomeryshire, 1931.

4 × 4 Latin Square. Plots 1/160th acre. Soil: Medium loam (Wenlock shale).
TREATMENTS: Superphosphate, Rock Phosphate and Slag, providing 1 cwt. P_2O_5 per acre.
Basal Manuring: 2 cwt. Sulphate of Ammonia and 1½ cwt. Sulphate of Potash per acre.
Variety: Lord Derby. Swedes sown: May 20th. Lifted: November 1st-4th.
Previous crop: Sugar Beet.

Average yield.	No Phosphate.	Slag.	Rock phosphate.	Super-phosphate.	Mean.	Standard Error.
Roots—						
Tons per acre ..	16.96	18.21	17.20	18.14	17.63	0.261
Per cent. ..	96.2	103.3	97.5	102.9	100.0	1.48
Tops—						
Tons per acre ..	4.80	6.41	4.93	5.41	5.39	0.093
Per cent.	89.1	119.0	91.5	100.4	100.0	1.73

Significant response to slag and to superphosphate, but not to rock phosphate. There is no significant difference between slag and superphosphate in the case of roots, but for the tops slag is significantly superior.

Swedes. County Farm Institute, Moulton, Northampton, 1931.

5 × 5 Latin Square. Plots 0.02 acre. Soil: Sandy loam.
TREATMENTS: Superphosphate, Mineral Phosphate, High and Low soluble Slag, all providing 1 cwt. P_2O_5 per acre.
Basal Manuring: 1½ cwt. Sulphate of Ammonia and 3 cwt. (30 per cent.) Potash Salts per acre.
Variety: Garton's Superlative. Swedes sown: June 9th. Lifted: November 12th.
Previous crop: Wheat.

Average yield.	No Phosphate.	Mineral Phosphate.	Low Slag.	High Slag.	Super-phosphate.	Mean.	Standard Error.
Roots—							
Tons per acre	28.53	29.01	28.99	27.76	27.54	28.37	0.804
Per cent. ..	100.6	102.3	102.2	97.8	97.1	100.0	2.83
Tops—							
Tons per acre	2.52	2.72	2.60	2.57	2.47	2.57	0.089
Per cent. ..	97.8	105.6	100.9	99.7	96.0	100.0	3.45

No significant results.

Swedes. Oundle School, Northamptonshire, 1931.

5 × 5 Latin Square. Plots 1/50th acre. Soil: Heavy loam on Oxford clay.
TREATMENTS: Superphosphate, Mineral Phosphate, High and Low soluble Slag, all providing 1 cwt. P_2O_5 per acre.
Basal Manuring: 1 cwt. Sulphate of Ammonia per acre.
Variety: Purple Top. Swedes sown: May 27th. Lifted: November 23rd.
Previous crop: Grey Winter Oats.

Average yield.	No Phosphate.	Mineral Phosphate.	Low Soluble Slag.	High Soluble Slag.	Super.	Mean.	Standard Error.
Roots (clean)							
Tons per acre	35.53	33.50	33.86	36.21	34.75	34.77	1.20
Per cent. ..	102.2	96.3	97.4	104.1	99.9	100.0	3.46

No significant effects.

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Cabbages. T. H. Ream, Esq., Portobello Farm, Nr. Potton, 1931. J. W. Dallas, Esq., County Organiser.

5 × 5 Latin Square. Plots 1/50th acre. Soil: Very poor light sand on Sandy Heath.
Basal Manuring for Potatoes: 3 cwt. Superphosphate and 3 cwt. Sulphate of Potash per acre.
Variety: Christmas Drumhead. Cabbages planted: July 21st. Counted: December 7th.
Previous crop: Early Potatoes, to which all the manures were applied.

Average	No Nitrate of Soda	1 cwt. N/Soda before sowing + 1 cwt. top dressed	2 cwt. Nitrate of Soda before sowing	3 cwt. Nitrate of Soda before sowing	2 cwt. N/Soda before sowing + 1 cwt. top dressed	Mean	Standard Error
No. per acre	4760	5670	4870	5750	6260	5462	285

There is a significant average response to nitrogen as measured by the number of cabbages cut. There is some indication that the split dressings are superior to single dressings.

Cabbages. T. H. Ream, Esq., Portobello Farm, Nr. Potton, 1931. J. W. Dallas, Esq., County Organiser.

4 × 4 Latin Square with split plots. Main Plots 1/30th acre. Soil: Very poor, light sand on Sandy Heath.
TREATMENTS: Increasing applications of Superphosphates to previous crop. Plots split for Sulphate of Ammonia at the rate of 2 cwt. per acre, and Nitrate of Soda equivalent to Sulphate of Ammonia.
Basal Manuring: 2 cwt. Sulphate of Potash per acre.
Variety: Christmas Drumhead. Cabbages planted: July 20th. Cut: December 11th—January 11th.
Previous crop: Potatoes, to which all manures were applied.

	Average weight per cabbage.					Average no. of cabbages gathered per acre.				
	No Super.	2 cwt. Super.	4 cwt. Super.	8 cwt. Super.	Mean.	No Super.	2 cwt. Super.	4 cwt. Super.	8 cwt. Super.	Mean.
S/Amm.	1.18	1.22	1.20	1.24	1.21	2318	2198	2798	2978	2572
N/Soda ..	1.32	1.33	1.30	1.22	1.29	2865	2790	2948	2925	2882
Mean ..	1.25	1.28	1.25	1.23	1.25	2591	2494	2872	2951	2727
Standard Error: single treatment = 0.038.						259				

The weight per cabbage is signficantly higher on the nitrate of soda plots, and the number of cabbages cut is also higher, though not significantly so. There are no other significant effects.

Kale. Midland Agricultural College, Loughborough, 1931.

4 × 4 Latin Square. Plots 1/50th acre. Soil: Light loam.
TREATMENTS: Increasing applications of Nitrate of Soda.
Basal Manuring: 15 tons Farmyard Manure per acre, 3 cwt. Superphosphate and 3 cwt. Potash Salt per acre.
Variety: Marrowstem. Kale sown April 24th. Cut: September 17th-October 3rd.
Previous crop: Oats.

Average yield	No Nitrogen	1 cwt. Nitrate of Soda	2 cwt. Nitrate of Soda	4 cwt. Nitrate of Soda	Mean	Standard Error.
Tons per acre ..	15.31	18.20	19.06	22.42	18.75	0.677
Per cent.	81.7	97.1	101.7	119.6	100.0	3.61

Definitely significant response to nitrogen, with a significant increase in yield at the higher levels.

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Brussel Sprouts. The Horticultural College, Swanley, 1931.

5 × 5 Latin Square. Plots 1/125th acre. Soil: Light calcareous loam.
TREATMENTS: Super and Potash (no Nitrogen), Poultry Manure, Guano, Artificials full N (0.4 cwt.), and Artificials ½ N (0.2 cwt.) at the rate of 0.4 cwt. N per acre.
Basal Manuring: Superphosphate at the rate of 0.8 cwt. P_2O_5, Sulphate of Potash at the rate of 1.0 cwt. K_2O per acre.
Brussels harvested: September 17th, October 12th, October 29th and November 2nd.

Average yield.	No Nitrogen	Artificials ½ N.	Artificials full N.	Guano.	Poultry Manure.	Mean.	Standard Error.
Cwt. per acre.							
1st Harvesting	10.4	9.8	13.9	13.2	15.7	12.6	1.55
2nd Harvesting	23.7	22.8	20.8	25.4	25.5	23.6	1.16
3rd Harvesting	14.0	13.1	12.5	13.2	12.7	13.1	1.09
4th Harvesting*	14.1	17.1	18.6	19.7	20.6	18.0	1.36
Per cent.							
1st Harvesting	82.4	77.6	110.4	104.6	125.0	100.0	12.33
2nd Harvesting	100.3	96.3	87.8	107.6	107.9	100.0	4.93
3rd Harvesting	106.6	99.8	95.6	100.7	97.3	100.0	8.31
4th Harvesting*	78.3	94.7	103.4	109.3	114.2	100.0	7.55

*Blown sprouts.

The response to poultry manure and guano is significant when the fourth harvesting (blown sprouts) is taken into account. The response to these two manures on the first three harvestings is not itself significant. The high standard error prevents any conclusions on the effects of artificials.

Hay. Haileybury College Farm, 1930.
H. W. Gardner, Esq., Agricultural Chemist, Hertfordshire Farm Institute.

5 × 5 Latin Square. Plots 1/50th acre. Soil: Light loam.
TREATMENTS: Top dressings of Sulphate of Ammonia, Cyanamide, Nitrate of Soda and Nitro-chalk equivalent to 1½ cwt. Sulphate of Ammonia per acre.
Hay cut: July 2nd, 1930.

Average yield.	No Nitrogen.	Sulphate of Ammonia.	Cyana-mide.	Nitrate of Soda.	Nitro-Chalk.	Mean.	Standard Error.
Cwt. per acre	60.6	72.1	69.0	66.1	70.8	67.7	1.75
Per cent...	89.4	106.5	101.9	97.6	104.5	100.0	2.58

Definitely significant response to nitrogen. There are no significant differences between the various forms of nitrogen.

Hay. Haileybury College Farm, 1931.
H. W. Gardner, Esq., Agricultural Chemist, Hertfordshire Farm Institute.

5 × 5 Latin Square. Plots 1/50th acre. Soil: Clay.
TREATMENTS: Top dressings of Sulphate of Ammonia, Cyanamide, Nitrate of Soda, Nitro-chalk equivalent to 1½ cwt. Sulphate of Ammonia per acre.
Hay cut: July 4th.

Average yield.	No Nitrogen.	Sulphate of Ammonia.	Cyana-mide.	Nitrate of Soda.	Nitro-chalk.	Mean.	Standard Error.
Cwt. per acre	35.7	44.6	38.3	44.8	42.5	41.2	1.52
Per cent. ..	86.7	108.4	93.1	108.7	103.2	100.0	3.69

Definitely significant response to nitrogen. Cyanamide is significantly inferior to sulphate of ammonia and nitrate of soda, but scarcely to Nitro-chalk.

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Grass. H. W. Gardner, Esq., Agricultural Chemist, Hertfordshire Farm Institute, 1931.

4 × 4 Latin Square. Plots 6 square yards. Soil: Loam.
TREATMENTS: Single (1 cwt. per acre) Sulphate of Ammonia applied early (March 2nd) and after June grazing, and Double Sulphate of Ammonia applied early (March 2nd). Single I.C.I. Fertiliser provided same amount of N. Plots receiving Sulphate of Ammonia also received the same P_2O_5 and K_2O as was provided by the I.C.I. Fertiliser. Sixty per cent. of the N removed in the crop corresponding to each treatment was returned to the land in the form of poultry manure.
Basal Manuring: 1 ton Lime, 4 cwt. Mineral Phosphate, and 2 cwt. Potash Salt (30 per cent.) per acre.
Grass cut: April 23rd, June 5th, July 20th and September 15th.

Average yield.	No Nitrogen.	S/Amm. Single E. and L.	S/Amm. Double E.	I.C.I. Fertiliser E. and L.	Mean.	Standard Error.
Dry matter—						
Cwt. per acre	70.6	81.0	77.8	78.1	76.9	2.60
Per cent.	91.8	105.4	101.2	101.6	100.0	3.38

The response to nitrogen is significant, but there is no difference between the different forms and times of application.

Hay. Lady Manner's School, Bakewell, 1931.

Three randomised blocks of 8 plots each. Plots 1/161 acre. Soil: Limestone.
TREATMENTS: 2 cwt. Nitrate of Soda (N), 3 cwt. Superphosphate (P) and 2 cwt. Kainit (K) per acre.
Manures applied March 20th.
Hay cut: June 30th.

Average yield.	O	N	P	K	NP	NK	PK	NPK	Mean.	S.E.
Cwt. per acre ..	39.3	49.6	41.4	36.4	49.6	43.1	37.8	60.4	44.7	2.82
Per cent.	87.9	110.9	92.7	81.4	110.9	96.5	84.7	135.0	100.0	6.31

Significant response to nitrate of soda, and to superphosphate in the presence of nitrate and kainit.

Hay. Lady Manner's School, Bakewell, 1931.

5 × 5 Latin Square. Plots 1/198th acre. Soil: Limestone.
TREATMENTS: Low and High Soluble Slag, Rock Phosphate and Superphosphate, providing 1.0 cwt. P_2O_5 per acre.
Manures applied: March 27th.
Hay cut: June 30th.

Average yield.	No Phosphate.	Low Soluble Slag.	High Soluble Slag.	Rock Phosphate.	Super.	Mean.	Standard Error.
Cwt. per acre	31.1	29.5	32.4	30.9	34.1	31.6	1.62
Per cent. ..	98.4	93.3	102.6	97.8	107.9	100.0	5.12

No significant response to manures.

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