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ROTHAMSTED  
RESEARCH

## Report for 1933

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## Continuous Rotation Experiments

### Rothamsted Research

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## FOUR COURSE ROTATION EXPERIMENT, ROTHAMSTED

### RESIDUAL VALUES OF HUMIC AND PHOSPHATIC FERTILISERS.

For details, see 1932 Report, p. 127.

#### MANURES APPLIED, SEASON 1932-3.

Treatment.	Organic Fertilisers (cwt. per acre).				Additional Artificial Fertilisers (cwt. per acre).		
	Organic Matter.	N.	K <sub>2</sub> O	P <sub>2</sub> O <sub>5</sub>	N. as S. of A.	K <sub>2</sub> O as Mur. Pot.	P <sub>2</sub> O <sub>5</sub> as Super.
1 ..	50 (as F.Y.M.)*	1.363	2.309	0.546	0.437	0.691	0.654
2 ..	50 (as Adco)	1.071	0.567	0.940	0.729	2.433	0.260
3 ..	97.26 (as straw)	0.379	1.325	0.122	1.421	1.675	1.079
4 ..		None			0.36	0.6	1.2
5 ..		None			0.36	0.6	1.2†

For analysis of fertilisers, see page 101.

†As Mineral Phosphate.

\* In 1932, owing to a mistake, 35.26 cwt. of organic matter was applied as F.Y.M., instead of 50 cwt. The total N, K<sub>2</sub>O and P<sub>2</sub>O<sub>5</sub>, however, were correct.

#### CULTIVATIONS, ETC.

	Barley.	Seeds.	Potatoes.	Wheat.
Variety .. ..	Plumage Archer	Italian ryegrass and commercial white clover	Ally	Yeoman
Date of Sowing ..	March 22	April 29	April 12	November 11
Manures Applied—				
Dung and Adco ..	Oct. 14	Oct. 14	Oct. 13 and 14	Oct. 13 and 14
Artificials to Adco and Dung ..	Oct. 29	Oct. 29	Oct. 18	Oct. 18
Straw ..	Dec. 5	Oct. 27	Nov. 7	Nov. 7 and 8
Artificials to straw	Dec. 5, Feb. 4, March 15	Oct. 29, Feb. 28, March 30	Feb. 28, Mar. 30, April 7	Nov. 9, Feb. 28, March 30
Treatments 4 and 5	March 10	March 7	April 7	Nov. 9, March 8
Date of Harvesting	August 1	Failed	Oct. 3	August 1
Previous Crop ..	Potatoes	Barley	Wheat	Seeds
Cultivations—				
Ploughing ..	Dec. 5		November 7	July 4, Nov. 7 & 8
Harrowing ..	Mar. 22, April 29		May 2	Nov. 11, Mar. 31
Hoeing ..			June 26	
Ridging ..			April 6 & 7, May 11	
Grubbing ..			May 23, June 26	



PLAN AND YIELDS

Barley—AB, Plots 1-25.

Yields in lb. grain above, straw below.

N.W.

5 60.3 72.0 I	2 50.2 58.3 IV	1 54.3 68.0 II	3 32.6 42.4 —	4 60.1 74.9 III
5 56.6 67.2 III	1 36.4 46.6 —	3 42.3 52.7 IV	4 70.5 78.5 I	2 46.1 56.6 II
3 47.0 56.8 III	2 57.1 73.2 I	5 49.6 65.4 —	4 56.2 73.8 II	1 34.9 45.6 IV
1 43.1 45.9 III	3 71.8 91.2 I	4 57.3 70.2 IV	5 42.5 68.8 II	2 29.0 40.5 —
4 55.4 68.4 —	1 64.3 77.2 I	5 37.7 61.0 IV	3 28.9 44.1 II	2 38.4 52.1 III

Seeds Hay—AH, Plots 26-50.

Crop failed.

N.W.

3 — III	2 — IV	5 — —	4 — II	1 — I
4 — IV	2 — II	1 — III	5 — I	3 — —
1 — II	4 — —	3 — I	5 — IV	2 — III
4 — I	5 — III	3 — II	2 — —	1 — IV
2 — 1	4 — III	3 — IV	1 — —	5 — II

Potatoes—AP, Plots 51-75.

Yields in lb.

N.W.

3 153.8 IV	4 251.8 I	1 143.0 —	2 87.5 II	5 108.0 III
3 123.0 —	4 192.5 III	5 162.5 IV	2 128.0 I	1 94.5 II
2 163.8 IV	4 152.8 —	3 148.8 III	1 159.0 I	5 90.0 II
5 167.8 —	1 148.5 IV	3 193.8 I	4 144.2 II	2 81.8 III
4 188.5 IV	2 98.2 —	1 148.0 III	5 153.0 I	3 146.5 II

Wheat—AW, Plots 76-100.

Yields in lb. grain above, straw below.

N.W.

4 71.2 90.8 III	2 66.6 81.9 IV	5 72.0 57.5 II	3 53.0 60.2 —	1 74.7 106.8 I
5 71.8 94.4 —	2 82.3 121.7 I	1 61.0 75.8 III	4 71.4 88.8 II	3 58.4 84.4 IV
2 62.8 77.2 II	1 61.8 79.7 IV	5 63.4 98.8 I	4 57.9 80.6 —	3 62.4 85.6 III
2 56.8 80.2 III	4 61.2 84.3 I	1 53.8 72.2 —	5 56.8 77.2 IV	3 60.4 87.1 II
5 66.3 88.2 III	2 43.6 62.4 —	3 76.2 118.8 I	1 59.9 84.1 II	4 68.1 97.9 IV



### SUMMARY OF RESULTS, 1933

Manure.	Year of Cycle.	Wheat. Cwt. per Acre.		Potatoes, tons per acre.	Barley. Cwt. per Acre.		Seeds Hay. Cwt. p.a. dry matter.
		Grain.	Straw.		Grain.	Straw.	
Manure as F.Y.M.	—	20.6	27.6	2.62	13.3	17.1	—
	I	28.6	40.8	2.91	23.6	28.3	—
	II	22.9	32.2	1.73	19.9	24.9	—
	III	23.3	29.0	2.71	15.8	16.8	—
	IV	23.6	30.5	2.72	12.8	16.7	—
Manure as Adco	—	16.7	23.9	1.80	10.6	14.8	—
	I	31.5	46.5	2.34	20.9	26.8	—
	II	24.0	29.5	1.60	16.9	20.7	—
	III	21.7	30.7	1.50	14.1	19.1	—
	IV	25.5	31.3	3.00	18.4	21.4	—
Manure as Straw	—	20.3	23.0	2.25	11.9	15.5	—
	I	29.1	45.4	3.55	26.3	33.4	—
	II	23.1	33.3	2.68	10.6	16.2	—
	III	23.9	32.7	2.73	17.2	20.8	—
	IV	22.3	32.3	2.82	15.5	19.3	—
Super.	—	22.1	30.8	2.80	20.3	25.1	—
	I	23.4	32.2	4.61	25.8	28.8	—
	II	27.3	34.0	2.64	20.6	27.0	—
	III	27.2	34.7	3.53	22.0	27.4	—
	IV	26.0	37.4	3.45	21.0	25.7	—
Rock Phosphate	—	27.4	36.1	3.08	18.2	24.0	—
	I	24.2	37.8	2.80	22.1	26.4	—
	II	27.5	22.0	1.65	15.6	25.2	—
	III	25.4	33.7	1.98	20.7	24.6	—
	IV	21.7	29.5	2.98	13.8	22.4	—

The number I denotes application of manure at the beginning of the present season (1932-3); II application in the previous season, etc. The plots above the lines have not yet had any manure, except those due to receive superphosphate and rock phosphate, which in the seasons 1931-2 and 1932-33 received one-fifth of their quinquennial total of potash and nitrogen. In the two previous seasons these plots, like the corresponding plots due to receive organic manures, were untreated.



## SIX COURSE ROTATION EXPERIMENT

SEASONAL EFFECTS OF N, P<sub>2</sub>O<sub>5</sub> AND K<sub>2</sub>O

(For details see 1932 Report, p. 131)

CULTIVATIONS, ETC.—ROTHAMSTED

	Forage.	Clover.	Wheat.	Potatoes.	Sugar Beet.	Barley.
Variety		Broad Red	Yeoman II	Ally .	Kuhn	Plumage Archer
Date of Sowing	Oct. 8	April 29	Oct. 4	April 12	May 8	March 22
Manures applied	Nov. 7, Mar. 9	Nov. 1, Mar. 9	Nov. 1, Mar. 9	April 11	May 4	March 10
Date of Harvesting	June 5	failed	July 26	Oct. 2	Nov. 11-13	Aug. 1
Previous crop	Potatoes	Barley	Clover	Wheat	Forage	Sugar Beet
Cultivations— Ploughing	Oct. 4	May 17	Aug. 16 & 17, Oct. 3	Sept. 16, April 5	Aug. 17, April 5	Nov. 17
Harrowing	Oct. 8, Mar. 31	May 19	Oct. 4, Mar. 31	April 10, May 2, May 18	Oct. 4, April 10 May 4, 8 & 10	March 22
Rolling		May 19	May 1	April 10	April 10, May 8 & 11	April 14
Singling					June 19-22	
Hoeing			April 19		June 14, July 17	
Ridging				April 11 & 15, May 18		
Grubbing				May 23, June 14 & 22		

### CULTIVATIONS, ETC.—WOBURN

	Sugar Beet.	Barley.	Forage.	Wheat.	Clover.	Potatoes.
Variety	Kuhn	Plumage Archer		Yeoman II	Broad Red	Ally
Date of Sowing	May 8	March 23	Oct. 14	Oct. 14	May 9	April 21
Manures applied	May 11	March 23 & 27	Oct. 27, Mar. 14	Oct. 27, Mar. 14	Oct. 28, Mar. 14	April 20
Date of Harvesting	Nov. 10	July 28 & 29	June 22 & 23	July 31	June 26	Sept. 14
Previous crop	Forage	Sugar Beet	Potatoes	Clover	Barley	Wheat
Cultivations— Ploughing	July 11, Sept. 9 April 24	Mar. 15	Oct. 14	Sept. 9		Oct. 4, April 5
Harrowing	July 15, Oct. 12 April 29, May 8	Mar. 15, 23 & 29 April 11 & 29, May 12 Mar. 29	Oct. 14	Oct. 12 & 14, Mar. 24, April 11 & 29		Oct. 14, April 11, April 19
Rolling	April 29, May 13					April 19
Singling	June 22 & 23					
Hoeing	May 27, June 25 & 27			April 29		
Ridging						April 19 & 21

H

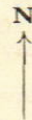


**ROTHAMSTED, 1933**

Forage—BF, Plots 1-15.

Yields in lb., hay as carted.

1P 135	3N 141	3K 111	2K 119	0K 125
2N 152	0P 141	1N 108	3P 118	4P 132
4N 149	0N 92	4K 97	1K 104	2P 109



Clover—BC, Plots 16-30.

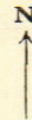
Crop failed.

1N —	2P —	0P —	1P —	1K —
3P —	0N —	4K —	3N —	2N —
4P —	3K —	2K —	0K —	4N —

Wheat—BW, Plots 31-45.

Yields in lb., grain above, straw below.

0K 55.0 90.8	3P 60.0 97.8	3N 53.3 95.7	0P 44.9 84.8	1N 46.8 87.0
1K 62.7 90.8	4P 65.8 96.7	2N 69.0 103.0	2K 60.2 94.8	3K 63.4 100.6
2P 53.5 79.5	1P 59.5 91.0	4N 68.2 110.3	0N 49.5 76.2	4K 43.2 77.8



Potatoes—BP, Plots 46-60.

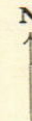
Yields in lb.

1P 212	3K 275	4N 282	2N 276	0N 233
4K 273	2K 284	0K 164	1N 237	4P 298
0P 211	3N 231	1K 293	3P 276	2P 245

Sugar beet—BS, Plots 61-75.

Yields in lb., roots (dirty) above, tops centre, sugar percentage below.

2P 124 145 14.18	3P 134 161 14.35	4N 140 171 14.64	3N 163 168 14.38	4K 140 144 14.21
1K 162 138 14.64	4P 178 150 14.27	0P 172 143 14.73	3K 213 162 14.99	2K 144 163 14.38
0K 114 152 14.30	1P 135 166 14.82	2N 118 157 14.61	0N 153 162 14.41	1N 162 154 14.35



Barley—BB, Plots 76-90.

Yields in lb., grain above, straw below.

2K 60.1 75.2	3K 58.8 75.4	1K 61.4 77.6	3N 61.6 78.4	3P 76.8 91.7
0P 60.8 74.4	1P 59.3 78.0	2N 66.9 87.4	0N 58.2 73.3	1N 69.9 87.8
4K 73.2 93.6	0K 60.3 79.0	4N 63.8 94.4	2P 68.6 92.9	4P 75.4 98.6



### WOBURN, 1933

**Sugar beet—CS, Plots 1-15.**

Yields in lb., roots (dirty) above, tops centre, sugar percentage below.

0N 538 303 17.76	2K 647 362 17.30	1K 660 355 17.50	0K 736 344 17.59	1P 673 327 16.66
1N 540 283 17.53	3K 567 293 17.12	3P 617 315 16.98	3N 645 332 16.63	0P 639 305 16.75
4K 576 369 17.73	2P 535 313 16.75	4P 569 320 16.20	4N 693 400 16.40	2N 671 331 17.41

N.W.  
↑

**Barley—CB, Plots 16-30.**

Yields in lb., grain above, straw below.

0K 55.8 125	3N 74.5 143	2P 77.2 136	1N 72.5 124	0P 67.2 130
4N 80.8 136	2N 67.0 127	4P 83.0 132	3K 78.2 139	2K 80.0 139
1K 67.8 116	0N 61.5 89	3P 79.0 128	1P 80.5 128	4K 75.0 121

**Forage—CF, Plots 31-45.**

Yields in lb., green weights.

1N 308	2K 383	1K 385	4P 394	4N 424
3K 375	0N 301	3P 380	3N 354	0P 409
4K 371	0K 324	2P 455	2N 399	1P 379

N.W.  
↑

**Wheat—CW, Plots 46-60.**

Yields in lb. grain above, straw below.

4P 30.8 60	3P 33.0 66	1P 34.5 73	3K 53.5 100	3N 66.0 125
0N 23.8 53	1N 25.2 56	4K 42.8 84	1K 55.8 106	2N 61.8 117
2P 27.0 65	0P 33.0 75	2K 47.8 94	4N 60.2 134	0K 57.8 119

**Clover—CC, Plots 61-75.**

Yields in lb., green weights.

4P 212	3P 226	0P 344	2N 327	1N 384
2P 235	0K 252	3N 268	4K 408	3K 475
1K 251	1P 262	4N 285	2K 453	0N 412

N.W.  
↑

**\*Potatoes—CP, Plots 76-90.**

Yields in lb.

3N 442	4N 501	2P 516	3P 508	4K 492
0K 458	2N 620	1N 518	3K 548	2K 505
1K 479	4P 542	0N 451	0P 490	1P 466

\*Owing to a mistake the ploughing ridge was made in the middle of the row of plots 86-90. The soil was as far as possible turned back again.



ROTHAMSTED, 1933

1.—Mean yields per acre and increments in yield per cwt of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O.

		Average, 1930-32	1933	Standard error, 1933			Average, 1930-32	1933	Standard error, 1933
<b>Sugar Beet</b> Roots (washed) tons	Yield.	6.80	2.13		<b>Clover Hay</b> Dry matter cwt.	Yield.	24.7		
	N	0.80	-0.23	±0.90		N	20.5	*	
	P	0.65	0.11	±0.90		P	0.9		
	K	-0.08	0.58	±0.54		K	1.8		
Tops tons	Yield	11.27	2.78		<b>Wheat</b> Grain cwt.	Yield	24.6	20.3	
	N	3.58	0.38	±0.39		N	0.3†	10.5	±5.9
	P	-0.16	0.11	±0.39		P	-1.2	10.1	±5.9
	K	-1.20	0.06	±0.23		K	2.7	-3.3	±3.5
Sugar percentage	Mean	17.15	14.48		Straw cwt.	Yield	55.9	32.8	
	N	-0.10	0.33	±0.54		N	30.2†	<b>18.3</b>	±5.7
	P	-0.27	-0.93	±0.54		P	2.7	7.2	±5.7
	K	0.41	0.07	±0.32		K	3.5	-2.3	±3.4
<b>Barley</b> Grain, cwt.	Yield	27.3	23.2		<b>Potatoes</b> tons	Yield	7.18	4.51	
	N	7.9	0.7	±3.6		N	2.12	1.10	±1.21
	P	-1.0	<b>11.1</b>	±3.6		P	0.09	<b>2.83</b>	±1.21
	K	0.2	3.3	±2.2		K	3.61	1.42	±0.73
Straw cwt.	Yield	31.8	29.9		<b>Forage</b> Dry matter cwt.	Yield	36.5	32.5	
	N	13.1	7.7	±4.9		N	19.3	<b>26.1</b>	±7.4
	P	6.7	<b>14.8</b>	±4.9		P	0.9	-6.5	±7.4
	K	4.8	3.8	±2.9		K	-1.8	-5.2	±4.4

\* Crop failed. † 1931 and 1932 only.  
Significant results in heavy type. Negative sign means depression.

2.—Average percentage increments in yield for each application of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O.

	N		P		K		Standard error, 1933
	Average 1930-32	1933	Average 1930-32	1933	Average 1930-32	1933	
<b>Sugar Beet</b> —Roots (washed) Tops Sugar percentage	1.91	-1.59	1.49	0.75	-0.34	6.85	±6.31
	5.66	2.05	-0.39	0.61	-2.48	0.54	±2.11
	0.66	0.34	0.10	-0.96	0.62	0.12	±0.55
<b>Barley</b> —Grain Straw	5.11	0.43	-0.47	<b>7.15</b>	0.00	3.58	±2.33
	6.74	3.87	-3.18	<b>7.41</b>	3.78	3.21	±2.46
<b>Clover Hay</b> —dry matter	10.99	*	0.42	*	2.05	*	—
<b>Wheat</b> —Grain Straw	2.08†	7.72	-1.07	7.47	2.64	-4.03	±4.33
	10.22†	<b>8.39</b>	0.21	3.30	1.36	-1.74	±2.63
<b>Potatoes</b>	4.60	3.66	-0.40	<b>9.42</b>	12.61	7.89	±4.04
<b>Forage</b> —dry matter	8.14	<b>12.02</b>	0.67	-3.01	-1.48	-4.00	±3.42

\* Crop failed. † 1931 and 1932 only.  
Significant results in heavy type. Negative sign means depression.



### WOBURN, 1933

1.—Mean yields per acre and increments in yield per cwt. of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O.

		Average 1930-32	1933	Standard error, 1933			Average 1930-32	1933	Standard error, 1933
<b>Sugar Beet</b> Roots (washed) tons	Yield	5.58	9.15		<b>Clover Hay</b> Dry matter cwt.	Yield	23.8*	26.3	
	N	0.79	<b>4.07</b>	±1.26		N	-6.2*	-15.0	±8.4
	P	-0.13	-1.92	±1.26		P	-3.6*	-18.0	±8.4
	K	2.02	-2.44	±0.76		K	4.4*	<b>13.7</b>	±5.0
Tops tons	Yield	6.84	5.89		<b>Wheat</b> Grain cwt.	Yield	8.2*	15.5	
	N	1.09	<b>2.89</b>	±0.96		N	10.3*	<b>27.1</b>	±5.9
	P	0.99	0.20	±0.96		P	-0.7*	-1.4	±5.9
	K	2.87	-0.08	±0.58		K	-1.6*	-4.6	±3.6
Sugar percent- age	Mean	17.09	17.09		Straw cwt.	Yield	27.4*	31.6	
	N	-1.31	-2.41	±0.55		N	24.6*	<b>54.9</b>	±7.8
	P	0.04	-0.52	±0.55		P	1.6*	-8.9	±7.8
	K	0.85	-0.04	±0.33		K	-6.4*	-10.8	±4.7
<b>Barley</b> Grain cwt.	Yield	20.2	26.2		<b>Potatoes</b> tons	Yield	9.40	8.97	
	N	19.6	<b>9.5</b>	±4.1		N	6.87	0.29	±1.94
	P	0.4	7.1	±4.1		P	0.55	1.74	±1.94
	K	3.8	<b>7.0</b>	±2.4		K	0.83	0.97	±1.17
Straw cwt.	Yield	41.7	45.5		<b>Forage</b> Dry matter cwt.	Yield	34.2*	47.5	
	N	22.7	<b>26.9</b>	±7.6		N	28.8*	<b>24.9</b>	±7.7
	P	-2.7	0.9	±7.6		P	2.4*	-6.9	±7.7
	K	9.5	2.2	±4.6		K	-1.0*	3.8	±4.6

\* 1931 and 1932 only.

Significant results in heavy type. Negative sign means depression.

2.—Average percentage increments in yield for each application of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O.

	N		P		K		Standard error, 1933
	1930-32 Average	1933	1930-32 Average	1933	1930-32 Average	1933	
<b>Sugar Beet</b> —Roots (washed) Tops Sugar percentage	2.54	<b>6.67</b>	-0.92	-3.14	8.23	-6.66	±2.06
	2.03	<b>7.36</b>	1.99	0.51	9.96	-0.36	±2.44
	-0.54	-2.12	0.05	-0.46	1.22	-0.06	±0.48
<b>Barley</b> —Grain Straw	15.36	<b>5.46</b>	0.15	4.05	5.17	<b>6.68</b>	±2.33
	8.16	<b>8.87</b>	-0.90	0.31	6.11	1.18	±2.51
<b>Clover Hay</b> —dry matter	-4.10*	-8.56	-2.28*	-10.27	4.57*	<b>13.04</b>	±4.77
<b>Wheat</b> —Grain Straw	16.80†	<b>26.11</b>	-0.16†	-1.35	-4.78†	-7.33	±5.72
	13.50†	<b>26.09</b>	0.86†	-4.21	-5.93†	-8.58	±3.69
<b>Potatoes</b>	12.36	0.49	-0.18	2.91	1.67	2.71	±3.25
<b>Forage</b> —dry matter	13.24†	<b>7.87</b>	0.18†	-2.17	-0.88†	2.02	±2.44

\* 1931 and 1932 only. (1931 crop was tares).

† 1931 and 1932 only.

Significant results in heavy type. Negative sign means depression.



## THREE COURSE ROTATION EXPERIMENT, ROTHAMSTED, 1933

### EFFECT OF PLOUGHING IN STRAW, AND OF WINTER GREEN-MANURE CROPS

**Object.**

1. To examine the possibility of using straw in autumn to conserve nitrogen, improve tilth and finally to improve crop yield.
2. To compare the direct application of straw and artificials with Adco compost made from equal straw, and also with dressings of artificial fertilisers.
3. In combination with the above to measure the improvement in soil fertility by winter cropping with rye or vetches.

**Rotation**

The rotation is barley, sugar beet, potatoes.

**Treatments.**

- (a) 1. No straw. Artificials applied in spring. (Ar)  
 2. Straw in autumn, artificials in spring. (St 1)  
 3. Straw in autumn, part of artificials in autumn, remainder in spring. (St 2)  
 4. Straw made into Adco compost applied in autumn. (Ad)
- (b) There are two series of plots which receive the above treatments in alternate years.  
 Series I. 1932-3 and alternate years thereafter.  
 Series II. 1933-4 and alternate years thereafter.
- (c) 1. No winter green-manure crop. (O)  
 2. Winter green-manure crop of rye. (R)  
 3. Winter green-manure crop of vetches. (V)  
 Treatments (c) are given every year.  
 There are thus 24 combinations of these treatments, and each is represented every year on every crop.

**Arrangement.**

There are three blocks of land, each of which carries a different crop. The crops rotate from block to block in successive years. Each block consists of twenty-four plots, carrying the twenty-four treatments arranged at random. A plot continues to receive the same treatment throughout the experiment. The experiment is situated in Long Hoos field (VI). Area of each plot: 1/50th acre.

**Rates of Application.**

Straw is applied at the rate of 53½ cwt. per acre.

The quantity of Adco compost applied per acre is the amount derived from the rotting of 53½ cwt. of straw.

Wherever artificials are applied in the experiment they consist of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O in the ratio 1 : 1 : 1.25.

Wherever straw is applied, artificials are given as follows: 0.4 cwt. N per acre, 0.4 cwt. P<sub>2</sub>O<sub>5</sub> per acre, 0.5 cwt. K<sub>2</sub>O per acre. In treatment St 2, half these quantities are given with the straw in the autumn.

The Adco compost is made with standard Adco powder used at a rate to give 0.4 cwt. N and 0.4 cwt. P<sub>2</sub>O<sub>5</sub> to 53½ cwt. of straw. When the Adco compost is applied to the plots, a dressing of 0.5 cwt. K<sub>2</sub>O per acre is given with it. Treatments Ar, Ad, St 1 and St 2 are thus equalised in respect of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O. In addition ground chalk is applied with treatments Ar, St 1 and St 2 at a rate equivalent to the CaO contained in the Adco powder used in making the quantity of Adco compost applied in treatment Ad.

Basal dressings are given to every plot of the potatoes and sugar-beet blocks in addition to the above application. Barley receives no additional basal dressing.

*Sugar Beet*: 0.2 cwt. N, 0.2 cwt. P<sub>2</sub>O<sub>5</sub>, 0.25 cwt. K<sub>2</sub>O per acre; *Potatoes*: 0.4 cwt. N, 0.4 cwt. P<sub>2</sub>O<sub>5</sub>, 0.50 cwt. K<sub>2</sub>O per acre.

**Form of Fertilisers.**

P<sub>2</sub>O<sub>5</sub> is given as superphosphate throughout the experiment.

	N	K <sub>2</sub> O
Autumn applications. All crops (treatment St 2)	Sulphate of Ammonia	Muriate of potash
Spring applications.		
<i>Barley</i>	Sulphate of Ammonia	Muriate of Potash
<i>Potatoes</i>	Sulphate of Ammonia	Sulphate of Potash
<i>Sugar-beet</i>	Nitrate of Soda	Muriate of Potash



Notes.

- (1) Green crops are sown as soon as possible after harvesting the previous crop, and are ploughed in 3 to 4 weeks before sowing the next crop, *i.e.*, there is no uniform time for sowing and ploughing in throughout the experiment. Weight of crop ploughed in is estimated by sampling.
- (2) Sugar-beet tops are carted off.
- (3) Departures from the scheme made in 1932-3, the first year of the experiment.
  - (a) Adco was applied in Spring.
  - (b) Straw was given at the rate of 60 cwt. per acre, with Adco corresponding.
- (4) The Adco used for this experiment was taken from the same batch as for the Four Course Rotation. (*See page 101*). For analysis of other fertilisers *see page 101*.

CULTIVATIONS, ETC.

	Barley	Potatoes	Sugar Beet
Variety	Plumage Archer	Ally	Kuhn
Date of Sowing	April 5	April 21	May 8
Manures applied			
Artificial—	November 4, April 5	November 4, April 21	November 4, May 6
Adco .. .. .	March 31	April 21	May 2
Straw .. .. .	November 8, April 4	November 8	November 8
Date of Harvesting .. .. .	August 14	October 3	October 19
Cultivations—			
Ploughing .. .. .	November 9 & 10, April 4	November 9 & 10, April 18	November 9 & 10, May 3 & 4
Harrowing .. .. .	November 11 & 15, April 5	November 11 & 15, April 20, May 6 & 18	November 11 & 15, May 5, 8 & 10
Rolling .. .. .	April 14	April 20	May 8 & 11
Singling .. .. .			June 22 & 23
Hoing .. .. .		June 24	June 13, July 17, 21 & 22
Ridging .. .. .		April 20, May 15 & 18, June 29	
Grubbing .. .. .		June 14 & 22	
Previous Crop .. .. .	Wheat, Oats and Barley	Wheat, Oats and Barley	Wheat, Oats and Barley



PLAN AND YIELDS

Sugar-Beet—DS, Plots 49-72.

Yields in lb., roots (dirty) above, tops centre, sugar percentage below.

N

St 1 R I 96.7 146.5 14.94	Ad R I 92.2 129.0 14.98	Ad V II 72.4 109.0 14.60	Ad V I 127.8 171.0 14.78	Ad R II 93.7 105.5 14.85	St 1 V I 119.4 142.0 14.89
St 1 O I 106.6 154.0 14.73	St 2 V II 115.6 154.0 15.02	St 1 V II 103.4 136.0 14.40	St 2 V I 158.8 198.0 14.78	St 2 R I 141.7 148.0 15.57	St 2 O I 147.6 154.0 15.07
Ar R I 97.4 132.0 15.00	Ar R II 119.2 143.5 15.14	Ar O I 130.1 172.0 14.92	Ad O I 171.2 178.0 15.35	St 1 O II 118.9 122.5 14.25	Ar V II 123.4 141.5 14.44
St 1 R II 119.6 165.0 15.05	Ad O II 148.9 186.5 15.25	St 2 R II 132.3 172.0 15.16	St 2 O II 158.4 179.5 14.62	Ar V I 193.7 215.5 15.04	Ar O II 154.6 163.0 14.52

Potatoes—DP, Plots 25-48. Yields in lb.

N

St 1 O II 158	Ad O I 199	Ad R II 116	Ar V II 127	Ar R I 214	St 2 O I 242
St 2 O II 177	Ad V II 183	St 2 R I 227	St 2 V I 220	St 1 R II 122	Ar O I 227
Ar R II 148	Ad O II 201	St 2 R II 175	St 1 V I 258	St 1 R I 240	Ad V I 180
Ad R I 184	Ar V I 255	St 1 O I 248	Ar O II 143	St 2 V II 126	St 1 V II 128

Barley—DB, Plots 1-24. Yields in lb., grain above, straw below.

N

St 1 R II 17.4 30.1	St 2 R I 28.3 44.7	Ar R I 33.5 48.8	St 2 O II 26.2 45.0	Ar O II 21.2 34.8	Ad O I 20.5 32.5
St 1 O I 35.8 62.2	St 2 R II 26.9 41.8	St 1 O II 26.8 40.0	Ar V II 33.4 48.6	Ad O II 31.0 48.5	St 2 O I 32.4 48.8
Ar R II 26.8 46.0	St 2 V I 24.6 44.4	Ar V I 40.0 65.5	St 1 R I 37.0 52.2	Ad R I 29.9 34.8	St 1 V II 25.0 38.2
Ad V II 38.7 69.8	Ar O I 29.2 55.3	Ad V I 34.3 46.0	St 2 V I 37.6 51.4	St 1 V I 34.0 46.8	Ad R II 22.5 28.5



SUMMARY OF RESULTS

		Manured, 1932-33.					Not yet Manured.				
		Artifi- cials.	Adco.	Straw. (St 1)	Straw. (St 2)	Mean.	Artifi- cials.	Adco.	Straw (St 1)	Straw (St 2)	Mean.
<b>Sugar Beet</b> Roots t.p.a. (±0.361)	None	2.47	3.25	2.02	2.80	2.64	2.94	2.83	2.26	3.01	2.76
	Vetches	3.68	2.43	2.27	3.02	2.85	2.34	1.38	1.96	2.20	1.97
	Ryegrass	1.85	1.75	1.84	2.69	2.03	2.26	1.78	2.27	2.51	2.20
	Mean	2.67	2.48	2.04	2.84	2.51	2.51	2.00	2.16	2.57	2.31
Tops Tons p.a. (±0.589)	None	3.84	3.97	3.44	3.44	3.67	3.64	4.16	2.73	4.01	3.64
	Vetches	4.81	3.82	3.17	4.42	4.06	3.16	2.43	3.04	3.44	3.02
	Ryegrass	2.95	2.88	3.27	3.30	3.10	3.20	2.35	3.68	3.84	3.27
	Mean ..	3.87	3.56	3.29	3.72	3.61	3.33	2.98	3.15	3.76	3.31
Sugar percentage (±0.305)	None	14.92	15.35	14.73	15.07	15.02	14.52	15.25	14.25	14.62	14.66
	Vetches	15.04	14.78	14.89	14.78	14.87	14.44	14.60	14.40	15.02	14.62
	Ryegrass	15.00	14.98	14.94	15.57	15.12	15.14	14.85	15.05	15.16	15.05
	Mean ..	14.99	15.04	14.85	15.14	15.00	14.70	14.90	14.57	14.93	14.78
Total Sugar Cwt.p.a.	None	7.4	10.0	6.0	8.4	8.0	8.5	8.6	6.4	8.8	8.1
	Vetches	11.1	7.2	6.8	8.9	8.5	6.8	4.0	5.6	6.6	5.8
	Ryegrass	5.6	5.2	5.5	8.4	6.2	6.8	5.3	6.8	7.6	6.6
	Mean ..	8.0	7.5	6.1	8.6	7.6	7.4	6.0	6.3	7.7	6.8
<b>Potatoes</b> Tons p.a. (±0.597)	None	5.07	4.44	5.54	5.40	5.11	3.19	4.49	3.53	3.95	3.79
	Vetches	5.69	4.02	5.76	4.91	5.10	2.83	4.08	2.86	2.81	3.14
	Ryegrass	4.78	4.11	5.36	5.07	4.83	3.30	2.59	2.72	3.91	3.13
	Mean ..	5.18	4.19	5.55	5.13	5.01	3.11	3.72	3.04	3.56	3.36
<b>Barley</b> Grain Cwt. p.a. (±2.34)	None	13.0	9.2	16.0	14.5	13.2	9.5	13.8	12.0	11.7	11.8
	Vetches	17.8	15.3	15.2	16.8	16.3	14.9	17.3	11.2	11.0	13.6
	Ryegrass	15.0	13.3	16.5	12.6	14.4	12.0	10.0	7.8	12.0	10.4
	Mean ..	15.3	12.6	15.9	14.6	14.6	12.1	13.7	10.3	11.6	11.9
Straw Cwt. p.a. (±4.47)	None	24.7	14.5	27.8	21.8	22.2	15.5	21.6	17.8	20.1	18.8
	Vetches	29.2	20.5	20.9	22.9	23.4	21.7	31.2	17.0	19.8	22.4
	Ryegrass	21.8	15.5	23.3	20.0	20.2	20.5	12.7	13.4	18.7	16.3
	Mean	25.2	16.8	24.0	21.6	21.9	19.2	21.8	16.1	19.5	19.2

Standard errors are computed from plots not yet manured.