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ROTHAMSTED  
RESEARCH

## Report for 1930

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### The Accuracy of the Field Experiments

#### Rothamsted Research

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*How much of the added phosphoric acid is taken up by the plant?*  
 The few experiments that have been made do not indicate a high percentage utilisation of the added phosphoric acid under normal conditions, even when the necessary nitrogen and potassium are supplied. Some of the results are given in Table XII.]

TABLE XII.—Recovery of Phosphoric Acid ( $P_2O_5$ ) from Phosphatic Fertilisers.

Normal Conditions.	Reference	$P_2O_5$ applied per acre.	$P_2O_5$ taken up by crop lb. per acre.			Percentage recovery.
			No Phosphate.	Phosphate.	Difference.	
<i>Superphosphate—</i> Swedes, 1st year	Little Hoos, Rothamsted	70	28.5	18.7	10	14
2nd, 3rd and 4th year after application ..						
Barley, 1st year	Little Hoos	70	22	17	5	7
Hay, 1st year ..	Essex	112	26	38	12	11
1st year ..	All centres	112	15	21.6	6.6	6
<i>Basic Slag—</i> (1) Hay, 1st year		100	10.2	14.8	4.6	3
1st 4 years			23.2	38.0	14.8	15
(2) Hay, 1st year	Essex	112	26	30	4	3.6
1st year ..	All centres	112	15	18.4	3.4	3
<i>Conditions of phosphatic starvation:</i>						
<i>Superphosphate—</i> Hay .. ..	Park Grass	64	10	26	16	25
Barley .. ..	Hoosfield	64	10.4	22.4	12	19
Wheat .. ..	Broadbalk	64	14.4	23.4	9.0	14

### THE ACCURACY OF THE FIELD EXPERIMENTS

The "average" "standard error" per plot for the different crops at Rothamsted, Woburn, and the various other centres are given in Table XIII; they were in 1930 of the same order as in previous years. At Rothamsted the error per plot varies round about 5 per cent of the total yield for Latin squares, and about 10 per cent for randomised blocks; it tends to be lower for potatoes and higher for wheat. Expressed as weights per acre the "standard error" for Latin squares is about 0.5 tons of roots and 1.3 cwt. of grain; for randomised blocks it is about 0.7 tons of roots and 1.5 to 3 cwt. of grain. At Woburn and the outside centres the figures are as usual somewhat higher, but again the Latin square is the more accurate. Even on commercial farms the "error" per plot amounts only to about 0.5 tons of potatoes in Latin squares and 1 ton or less in randomised blocks; with good yields this gives the same percentage error as at Rothamsted. The Latin square is thus the more accurate and we recommend its use wherever practicable. It is used for manurial trials at our outside centres on commercial farms without difficulty. Its range of usefulness has been still further increased in recent years by splitting each plot so as to test some other treatment superimposed on the entire series, e.g., phosphate or no phosphate on each of a set of plots receiving various nitrogenous manures. For cultivation and variety trials involving

a large number of comparisons the Latin square is not always practicable and then the randomised blocks can be used.

The fact that the size of the standard error remains approximately the same from year to year, suggests that our present appliances and our methods have reached their limit of accuracy; new and more accurate ones are now being sought. None of the various devices so far tried has constituted any real improvement, and so far as we can see the limit is set by the implements. Both seed and manure drills are admittedly defective; we have had to return to the old Coulter drill as the best we could find. Application of manures to the replicated plots is always by hand, but we urgently need better seed drills and better methods of distributing the fertiliser so that it shall act most effectively.

The sampling method continues to be useful. It is liable to be less accurate than the older method of harvesting the entire plot, but it saves a great amount of labour, and it allows of many more comparisons than would otherwise be possible.

TABLE XIII.—Standard Errors per Plot, 1930.

*Weight per acre.*

*Rothamsted.*

	Pota- toes. tons.	Sugar Roots. tons.	Beet. Tops. tons.	Barley. Grain. cwt.	Straw. cwt.	Wheat. Grain. cwt.	Straw. cwt.
<i>Latin Squares—</i>							
Average 1925–1930 .. ..	0.4	0.6	0.7	1.3	1.9	—	—
1930 .. ..	—	0.3	0.3	1.1	1.6	—	—
<i>Randomised Blocks—</i>							
Average 1925–1930 .. ..	0.7	0.3†	1.2†	1.5	1.9	2.9	4.3
1930 .. ..	0.6	—	—	—	—	1.5 } 3.7 }	0.8 } 7.1 }

† Single figure.

*Woburn.*

	Potatoes. tons.	Sugar Beet. Roots. tons.	Tops. tons.
<i>Latin Squares—</i>			
Average 1926–1930 .. ..	0.5	1.3	1.1
1930 .. ..	0.5 } 0.8 }	0.8	0.7
<i>Randomised Blocks—</i>			
Average 1926–1930 .. ..	0.7	1.0	1.5
1930 .. ..	—	—	—

Outside Centres.

Potatoes—tons

	Wis-bech.	Tunstall-Ipswich.	Pourme.	Biggles-wade.	Owmy	Midland Ag. Col.	Welsh-pool.	Burford	Nateby.	Great Nash.	Hull.
<i>Latin Squares—</i>											
Average 1927-30 ..	0.6*	—	—	—	0.4*	0.4†	—	—	—	—	—
1930 ..	0.8	—	—	0.6 0.3	0.3	—	—	1.1	0.5	0.4	0.9
<i>Randomised Blocks—</i>											
No previous experiments in many of these cases.											
Average 1927-30 ..	—	—	—	—	—	—	—	—	—	—	—
1930 ..	—	1.1	1.3	0.7	—	0.9	0.7	—	—	—	—

† Mean of 2.

\* Single figure.

Outside Centres (cont.)

	Sugar Beet—tons.										Barley †	
	Colchester Roots Tops		Welshpool		Wye		Moulton		Askham Bryan		Wye Grain cwt.	Wye Straw cwt.
<i>Latin Squares—</i>												
Average 1927-1930	0.5	0.3*	—	—	0.6	—	—	—	—	—	—	—
1930	—	—	—	—	0.4 0.3	0.8	1.0	1.7	0.5	0.4	1.5	1.4
<i>Randomised Blocks</i>												
Average 1927-1930	0.9†	—	0.7	1.4	—	—	—	—	—	—	—	—
1930	1.2	1.0	0.3	0.5	—	—	—	—	—	—	—	—

\* Single figure.

† Mean of 2.

‡ Expts. harvested by sampling method excluded.

TABLE XIII. (continued)—Standard Errors per Plot.

Per cent. of yield.

Rothamsted.

	Potatoes.	Sugar Beet.		Barley.		Wheat.	
		Roots.	Tops.	Grain.	Straw.	Grain.	Straw.
<i>Latin Squares—</i>							
Average 1925-30 ..	4.4	5.7	5.6	5.6	7.4	—	—
1930 ..	—	3.5	3.1	4.5	6.0	—	—
<i>Randomised Blocks—</i>							
Average 1925-1930	8.4	10.2*	10.9*	9.1	7.2	14.0	10.8
1930 ..	7.2	—	—	—	—	9.6 13.8	3.2 11.9

\* Single figure.

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Woburn.

					Potatoes.	Sugar Beet.	
						Roots.	Tops.
<i>Latin Squares—</i>							
Average 1926-1930	..	..	..	..	5.1	9.1	11.0
1930	..	..	..	..	4.7 } 7.0 }	8.6	9.4
<i>Randomised Blocks—</i>							
Average 1926-1930	..	..	..	..	8.7	12.5	19.1
1930	..	..	..	..	—	—	—

Outside Centres.

Potatoes.

	Wis- bech	Tun- stall. Ips- wich.	Bourne.	Biggles- wade.	Ownby	Midland College.	Welsh- pool.	Burford	Nateby.	Great Nash.	Hull.
<i>Latin Squares—</i>											
Average 1927-30	..	3.9*	—	—	4.5*	5.6†	—	—	—	—	—
1930	..	5.0	—	—	4.2 } 4.8 }	2.8	—	12.0	5.7	4.7	8.2
<i>Randomised Blocks—</i>											
Average 1927-30	..	No previous experiments in many of these cases.									
1930	..	—	8.2	11.3	4.3	—	9.0	5.8	—	—	—

		Sugar Beet.							Barley ‡				
		Colchester.		Welshpool.		Wye.		Moulton.		Leeds.		Wye.	
		Roots	Tops									Grain	Straw
<i>Latin Squares—</i>													
Average 1927-30	..	7.2	5.3†	—	—	5.2	—	—	—	—	—	—	—
1930	..	—	—	—	—	3.1 } 2.1 }	5.2 } — }	8.5	12.2	5.0	4.1	7.8	8.3
<i>Randomised Blocks—</i>													
Average 1927-30	..	10.1*	—	5.3	6.9								
1930	..	12.8	12.2	2.2	2.8								

\* Mean of 2.  
† Single figure.  
‡ Expts. harvested by sampling method excluded.

SOIL MICRO-ORGANISMS

*Lucerne.* The arrangements for supplying farmers with cultures of the necessary organisms are working smoothly and Messrs. Allen and Hanburys report that the demand during 1930 was more than three times that of the previous year, enough cultures being distributed to inoculate between 4,000 and 4,500 acres. The Ministry's return show that the acreage of lucerne in the country increased by over 4,000 acres in spite of the fall in acreage of arable land. Experiments are in hand to see whether seedsmen can inoculate the seed before sale; this will save much trouble both in distribution and on the farm.