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Details of the Classical and Long-term Experiments Up to 1962

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Deep-cultivation Rotation- Rothamsted

Rothamsted Research

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DEEP-CULTIVATION ROTATION EXPERIMENT, LONG HOOS I AND II, 1944-1957

The objects of the experiment were: (1) to compare deep ploughing with shallow ploughing (2) to test dung ploughed in at the two depths (3) to test superphosphate and muriate of potash broadcast on the seedbed or ploughed in before preparing the seedbed. These treatments were tested factorially on a rotation of crops sugar beet, barley, one year seeds mixture, wheat, potatoes, spring oats. There were six series, one for each crop of the rotation. Each series had 16 main plots for the combinations of the ploughing, farmyard manure, phosphate and potash treatments. The main plots were split to test the method of application of the phosphate and potash fertilisers. The treatments were repeated on their plots.

System of replication: 2 blocks of 8 plots each in each series, the four-factor interaction of main plot treatments being confounded with block differences.

Area of each whole plot: 0.0132 acre.

Whole plots: All combinations of:-

- (1) Shallow (6") v. deep (12") ploughing. Ploughing done on stubbles in autumn for sugar beet and potatoes, and on the hay stubble in summer for wheat.

	Sugar Beet	Potatoes
(2) No FYM v. FYM ploughed in	10 tons	20 tons
(3) No phosphate v. superphosphate	0.6 cwt. P ₂ O ₅	0.8 cwt. P ₂ O ₅
(4) No potash v. muriate of potash	0.6 cwt. P ₂ O ₅	1.0 cwt. K ₂ O
	all amounts per acre	

Half plots, sugar beet and potatoes only:-

P or K or PK ploughed in v. P or K or PK in seedbed for sugar beet and in ridges for potatoes.

Basal manuring: Applied in the ridges for potatoes, as a topdressing to wheat and in the seedbed for other crops:-

	Sugar Beet (Klein Wanzleben E)	Barley (Plumage Archer)	Ley*	Wheat (Yeoman)	Potatoes (Majestic)	Oats (Star)
Sulphate of ammonia (cwt. N per acre)	0.8	0.3	-	0.5	0.6	0.2
Basic slag (cwt. P ₂ O ₅ per acre)	-	0.6	-	-	-	-

* Seeds mixture: Varied slightly but usually 18 lb. Perennial ryegrass, 8 lb. Late Flowering Red clover, 2 lb. Alsike clover per acre.

Since 1952 ground chalk providing 10 cwt. CaO per acre was applied for barley.

Non-experimental Cultivations: These were carried out over the whole of any series, with the proviso that they must not be deeper than 6 inches except that deep ploughed plots might be worked to a depth of below 6 inches for the root crops.

DEEP CULTIVATION

Ploughing: The plough used for deep cultivations was a Ransome Solotrac giving a depth of 12 inches at least. In 1944 a Massey Harris Grub Breaker was used which did not always reach 12 inches, the actual depth in that year being 9-12 inches. Until 1947 the whole of the seeds area was ploughed 6" deep after the hay was carted, the deep ploughing being carried out subsequently at the same time as the stubbles were deep ploughed for roots. In autumn 1946 the second ploughing of the seeds could not be carried out owing to wet conditions, so there was no test of deep ploughing on wheat in 1947. In summer 1947 and subsequently the deep and shallow ploughing treatments were carried out directly on the hay stubble.

For summary of the results from 1944-49 see Rep. Rothamst. exp. Sta. for 1949, p. 140.

For summary of results 1944-56 see Rep. Rothamst. exp. Sta. for 1957, p. 193.

Table 33

DEEP-CULTIVATION ROTATION EXPERIMENT

Direct effects and interactions, means over 12 years 1944-55

Response to	Mean	Ploughing		Dung		Phosphate		Potash	
		Shallow	Deep	Absent	Present	Absent	Present	Absent	Present
Sugar beet, total sugar: cwt. per acre; mean yield 45.2									
Ploughing, deep-shallow	2.9	-	-	3.7	2.1	2.5	3.3	3.3	2.5
FYM	6.8	7.6	6.0	-	-	7.8	5.8	8.3	5.3
Phosphate	1.1	0.7	1.5	2.1	0.1	-	-	1.2	1.1
Potash	2.2	2.6	1.8	3.7	0.7	2.2	2.1	-	-
Potatoes, ware tubers: tons per acre; mean yield 8.88									
Ploughing, deep-shallow	0.00	-	-	0.14	-0.13	0.23	-0.22	-0.11	0.12
FYM	2.66	2.80	2.52	-	-	2.55	2.76	3.60	1.72
Phosphate	0.62	0.85	0.40	0.52	0.73	-	-	0.46	0.79
Potash	1.53	1.41	1.64	2.47	0.59	1.37	1.69	-	-

Table 34

DEEP-CULTIVATION ROTATION EXPERIMENT

RESIDUAL EFFECTS

Mean yields, cwt. per acre, and increases for deep ploughing, dung, P and K

Means over 12 years, Barley and oats, 1945-56, hay 1946-57

	Barley	Oats	Hay	Wheat
Mean yield	32.1	32.2	59.8	33.4
Residuals	1st year	1st year	2nd year	3rd year
Deep ploughing	+0.2	-1.2	-0.2	-0.5*
FYM	+1.8	+1.2	+4.0	+1.4†
Phosphate	+0.6	+0.9	+0.9	+0.2†
Potash	+0.6	+0.1	+1.9	+0.5†

*Direct effect of deep ploughing 1946 and 1948-57
†1947-57