

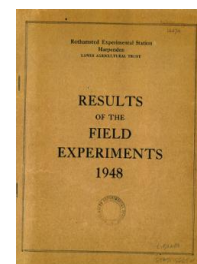
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48/BB/1 Six Course Rotation - Deep Cultivation

Rothamsted Research

Rothamsted Research (1949) *48/BB/1 Six Course Rotation - Deep Cultivation* ; Yields Of The Field Experiments 1948, pp 29 - 37

48/Bb/1

DEEP CULTIVATION ROTATION EXPERIMENT

Long Hoos I and III, 1948

Objects:

- (1) To compare deep ploughing (about 12 inches) with shallow (about 6 inches)
- (2) To compare the effects of ploughing in the mineral fertilizers at different depths with applying them in the seedbed.
- (3) To compare the effects of ploughing in dung at different depths.

Rotation: Sugar beet, barley, clover-ryegrass ley, wheat, potatoes, spring oats. (Ley ploughed in (not deeper than 6 inches) soon after first cut. Sugar beet tops carted off).

Treatments:

Whole plots. All combinations of:

1. Shallow ploughing (6 inches) v. deep ploughing (12 inches). (This is done before potatoes and sugar beet, and after ley before wheat, at the same time in autumn for all three).
2. Farmyard manure: None v. 20 tons per acre for potatoes and 10 tons per acre for sugar beet, applied before ploughing.
3. Superphosphate: None v. 0.8 cwt. P_2O_5 per acre for potatoes and 0.6 cwt. P_2O_5 per acre for sugar beet.
4. Muriate of potash: None v. 1.0 cwt. K_2O per acre for potatoes and 0.6 cwt. K_2O per acre for sugar beet.

Treatments 2, 3 and 4 are applied only to potatoes and sugar beet.

Half plots (potatoes and sugar beet):

Phosphate and potash (where given) ploughed in v. applied in the seedbed.

Basal manuring: Applied in the ridges for potatoes, as a top dressing for wheat, and in the seed bed for other crops.

Sulphate of ammonia, for potatoes 0.6 cwt. N per acre, for sugar beet 0.8 cwt. N per acre, for spring oats 0.2 cwt. N per acre, for wheat 0.5 cwt. N per acre, for barley 0.3 cwt. N per acre.

Basic slag, for barley 0.6 cwt. P_2O_5 per acre.

Area of each whole plot: 0.03125 acre (before rejecting edge rows).

Cultivations, etc.:

Ley. Series 1-KS.

Seeds undersown in barley: Apr 12, 1947. Rolled: Mar 10, 1948. Cut: June 14, 15. Seeds mixture per acre: 18 lb. ryegrass (Aberystwyth S2.4), 8 lb. late flowering red clover (Cert. N.Z. Mother seed), 2 lb. Alsike clover. Previous crop: Barley.

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Potatoes. Series 2 - KP.

Artificially applied: Sept 29. Dung applied (before deep ploughing), ploughed deep (about 12 inches): Sept 30. Dung applied (before shallow ploughing), ploughed shallow (about 6 inches): Oct 1,2. Cultivated: Mar 11, 20. Rolled and springtine harrowed: Mar.22. Harrowed twice, ring rolled: Mar.23. Ridged: Mar 31. Spring artificials applied, potatoes planted and covered in: Apr 7. Rolled down ridges: Apr 12. Ridges harrowed: May 10. Grubbed: June 9, 18. Earthed up: June 19,21. Hand weeded: June 10-11, July 28. Sprayed with "Perinox": Aug 9. Sprayed to kill haulm: Sept 13. Lifted: Sept 30. Variety: Majestic (Scotch seed A). Previous crop: Wheat.

Spring oats. Series 3 - KO.

Ploughed: Oct 15-20. Springtine harrowed: Mar 1. Sulphate of ammonia applied; seed drilled and harrowed in: Mar 5. Ring rolled: Mar 9. Weeded: May 28 - June 7. Harvested: Aug 16. Variety: Star. Previous crop: Potatoes.

Sugar beet. Series 4 - KS.

Artificially applied (before ploughing): Sept 29. Dung applied (before deep ploughing), ploughed deep (about 12 inches): Sept 30. Dung applied (before shallow ploughing); ploughed shallow (about 6 inches): Oct. 1,2. Cultivated: Mar 11,20. Rolled and springtine harrowed: Mar 22. Harrowed twice, ring rolled: Mar 23. Spring artificials applied: Apr 13. Harrowed: Apr 14. Seed drilled: Apr 15. Harrowed in: Apr 16. Ring rolled: Apr.22. Dusted with Flea beetle dust: May 8, 14, 15. Thistles hand weeded: June 5. Hoed: June 7 - July 21. Singled: June 8. Hand weeded for thistles: July 28. Lifted: Dec 2-4. Variety: Klein E. Previous crop: Oats.

Barley. Series 5 - KB.

Ploughed: Nov. 22-25. Springtine harrowed: Mar 1. Artificially applied, seed drilled and harrowed in: Mar 5. Ring rolled: Mar 9. Seeds mixture undersown: Apr 15. Harrowed and ring rolled: Apr 16. Weeded: May 28 - June 7. Harvested: Aug 16. Variety: Plumage Archer. Previous crop: Sugar beet.

Wheat. Series 6 - KW.

Ploughed: June 17-18, 1947. Ring rolled: June 19. Ploughed deep (about 12 inches): Sept 1. Ploughed shallow (about 6 inches) Sept 2. Cultivated (deep ploughed plots twice, shallow ploughed plots once), ring rolled deep ploughed plots, all plots cultivated: Oct 2. Rolled twice and springtine harrowed: Nov 1. Rolled and springtine harrowed twice: Nov 3. Seed drilled and harrowed in: Nov 4. Rolled: Mar 16. Sulphate of ammonia applied: May 5. Weeded: May 28-June 7. Harvested: Aug 16. Variety: Yeoman. Previous crop: Seeds

Standard errors per plot:

Ley. 1.58 cwt. per acre or 2.4% (4 d.f.)

Potatoes. Ware yield, whole plot, 2.058 tons per acre or 13.9% (4 d.f.)
sub-plot, 2.506 tons per acre or 16.9% (7 d.f.)

Spring oats. Grain, 4.46 cwt. per acre or 14.5% (4 d.f.)

48/Bb/1.3

Sugar beet. Total sugar, whole plot, 3.19 cwt. per acre or 6.0% (4 d.f.)
sub-plot, 5.87 cwt. per acre or 11.1% (7 d.f.)
Tops, whole plot, 0.651 tons per acre or 3.5% (4 d.f.)
sub-plot, 1.849 tons per acre or 9.9% (7 d.f.)
Barley. Grain, 0.846 cwt. per acre or 2.1% (4 d.f.)
Wheat. Grain, 2.69 cwt. per acre or 7.1% (4 d.f.)

48/Bb/1.4

Series I, Ley
Residual Effects

	Mean	Ploughing		Dung		Super		Potash	
		Shallow	Deep	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.
Hay: Mean yield 66.5 cwt. per acre (± 1.12 , Means ± 0.79)									
Ploughing deep									
-shallow	-1.1	-	-	-1.6	-0.6	-1.7	-0.5	-1.1	-1.1
Dung	3.3	2.8	3.8	-	-	0.9	5.7	2.2	4.4
Superphosphate	1.0	0.4	1.6	-1.4	3.4	-	-	4.2	-2.2
Potash	5.8	5.8	5.8	4.7	6.9	9.0	2.6	-	-

Series 2, Potatoes

	Mean	Ploughing		Dung		Super		Potash	
		Shallow	Deep	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.
Ware tubers: Mean yield 14.85 tons per acre (± 1.46 , Means ± 1.03)									
Ploughing deep									
-shallow	0.23	-	-	0.63	-0.17	0.98	-0.52	-1.62	2.08
Dung	4.64	5.04	4.24	-	-	4.23	5.05	6.29	2.99
Superphosphate	1.57	2.32	0.82	1.16	1.98	-	-	0.56	2.58
Potash	2.37	0.52	4.22	4.02	0.72	1.36	3.38	-	-

Percentage ware: Mean 98.7

Ploughing deep									
-shallow	0.3	-	-	0.2	0.4	0.4	0.2	0.2	0.4
Dung	0.4	0.3	0.5	-	-	0.3	0.5	0.6	0.2
Superphosphate	0.0	0.1	-0.1	-0.1	0.1	-	-	0.1	-0.1
Potash	0.5	0.4	0.6	0.7	0.3	0.6	0.4	-	-

48/Bb/1.5

Series 2, Potatoes

	Superphosphate			Potash			Mean
	None	Ploughed in	In ridges	None	Ploughed in	In ridges	
Ware tubers: tons per acre							
	(a)	(b) and (c)		(a)	(b) and (c)		
Shallow	13.57	14.77	17.02	14.47	14.58	15.41	14.74
Deep	14.55	14.51	16.24	12.85	15.82	18.34	14.97
No Dung	11.95	11.40	14.82	10.52	13.39	15.70	12.53
Dung	16.18	17.88	18.44	16.81	17.02	18.05	17.17
Mean	14.06	14.64	16.63	13.66	15.20	16.87	14.84
Percentage ware							
Shallow	98.5	98.4	98.8	98.3	98.6	99.0	98.5
Deep	98.8	98.6	98.8	98.5	99.0	99.2	98.8
No Dung	98.5	98.2	98.7	98.1	98.6	99.0	98.5
Dung	98.8	98.8	98.9	98.7	99.0	99.1	98.9
Mean	98.7	98.5	98.8	98.4	98.8	99.1	98.7

Standard errors (a) ± 1.03 (b) ± 1.25 (c) ± 1.36

Standard error (b) is for use in horizontal comparisons only; standard errors (a) and (c) for use in all other comparisons.

Series 3, Spring Oats

Residual Effects

	Mean	Responses to treatments							
		Ploughing		Dung		Super		Potash	
		Shallow	Deep	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.

Grain: Mean yield 30.8 cwt. per acre (± 3.16 , Means ± 2.23)

Ploughing deep - shallow	0.9	-	-	2.4	-0.6	-1.8	3.6	-0.1	1.9
Dung	-0.2	1.3	-1.7	-	-	-0.2	-0.2	-2.1	1.7
Superphosphate	-1.0	-3.7	1.7	-1.0	-1.0	-	-	0.8	-2.8
Potash	-1.3	-2.3	-0.3	-3.2	0.6	-0.5	-3.1	-	-

Straw: Mean yield 49.8 cwt. per acre

Ploughing deep - shallow	2.5	-	-	4.1	0.9	0.4	4.6	1.8	3.2
Dung	1.8	3.4	0.2	-	-	3.0	0.6	1.0	2.6
Superphosphate	-3.0	-5.1	-0.9	-1.8	-4.2	-	-	-1.4	-4.6
Potash	-1.9	-2.6	-1.2	-2.7	-1.1	-0.3	-3.5	-	-

48/Bb/1.6

Series 4: Sugar Beet

	Mean	Responses to treatments							
		Ploughing		Dung		Super		Potash	
		Shallow	Deep	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.
Total Sugar: Mean yield 52.9 cwt. per acre (± 2.25 , Means ± 1.59)									
Ploughing deep									
-shallow	-4.5	-	-	-0.8	-8.2	-4.9	-4.1	-1.3	-7.7
Dung	2.6	6.3	-1.1	-	-	3.7	1.5	5.5	-0.3
Superphosphate	-0.4	-0.8	0.0	0.7	-1.5	-	-	-0.3	-0.5
Potash	0.6	3.8	-2.6	3.5	-2.3	0.7	0.5	-	-

Roots (washed): Mean yield 15.75 tons per acre									
	Mean	Shallow	Deep	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.
Ploughing deep									
-shallow	-1.13	-	-	-0.15	-2.11	-1.22	-1.04	-0.35	-1.91
Dung	0.91	1.89	-0.07	-	-	1.09	0.73	1.48	0.34
Superphosphate	-0.06	-0.15	0.03	0.12	-0.24	-	-	-0.24	0.12
Potash	0.25	1.03	-0.53	0.82	-0.32	0.07	0.43	-	-

Sugar Percentage: Mean 16.79

	Mean	Shallow	Deep	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.
Ploughing deep									
-shallow	-0.19	-	-	-0.06	-0.32	-0.22	-0.16	0.01	-0.39
Dung	-0.15	-0.02	-0.28	-	-	0.00	-0.30	0.14	-0.44
Superphosphate	-0.02	-0.05	0.01	0.13	-0.17	-	-	0.19	-0.23
Potash	-0.08	0.12	-0.28	0.21	-0.37	0.13	-0.29	-	-

Tops: Mean yield 18.62 tons per acre (± 0.461 , Means ± 0.326)

	Mean	Shallow	Deep	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.
Ploughing deep									
-shallow	2.60	-	-	2.54	2.66	1.52	3.68	2.13	3.07
Dung	1.65	1.59	1.71	-	-	0.94	2.36	0.64	2.66
Superphosphate	-0.01	-1.09	1.07	-0.72	0.70	-	-	-0.96	0.94
Potash	1.44	0.97	1.91	0.43	2.45	0.49	2.39	-	-

Plant Number: Mean 18.3 thousands per acre

	Mean	Shallow	Deep	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.
Ploughing deep									
-shallow	-0.7	-	-	-0.4	-1.0	-0.5	-0.9	-0.3	-1.1
Dung	0.4	-0.7	0.1	-	-	0.6	0.2	0.4	0.4
Superphosphate	-0.3	-0.1	-0.5	-0.1	-0.5	-	-	-0.1	-0.5
Potash	-0.1	0.3	-0.5	-0.1	-0.1	0.1	-0.3	-	-

Noxious Nitrogen: Mean 43.9

	Mean	Shallow	Deep	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.
Ploughing deep									
-shallow	4.9	-	-	5.8	4.0	4.1	5.7	4.9	4.9
Dung	1.8	2.7	0.9	-	-	2.4	1.2	-0.1	3.7
Superphosphate	-0.9	-1.7	-0.1	-0.3	-1.5	-	-	0.6	-2.4
Potash	2.4	2.4	2.4	0.5	4.3	3.9	0.9	-	-

48/Bb/1.7

Series 4. Sugar Beet

	Superphosphate			Potash			Mean
	None	Ploughed in	In seed bed	None	Ploughed in	In seed bed	
Total Sugar: cwt per acre							
	(a)	(b) and (c)		(a)	(b) and (c)		
Shallow	55.5	57.0	52.5	53.2	60.1	54.0	55.1
Deep	50.6	53.0	48.4	52.0	54.3	44.3	50.7
No dung	51.2	53.4	50.6	49.9	57.8	48.9	51.6
Dung	54.9	56.6	50.3	55.3	56.6	49.4	54.2
Mean	53.1	55.0	50.5	52.6	57.2	49.2	52.9

Roots (washed): tons per acre							
Shallow	16.40	16.83	15.66	15.80	17.75	15.93	16.32
Deep	15.17	16.02	14.39	15.45	16.55	13.30	15.19
No dung	15.23	15.69	15.04	14.89	17.01	14.41	15.30
Dung	16.33	17.17	15.01	16.37	17.29	14.82	16.21
Mean	15.78	16.43	15.02	15.63	17.15	14.61	15.75

Sugar Percentage							
Shallow	16.91	16.93	16.78	16.83	16.94	16.95	16.88
Deep	16.69	16.59	16.82	16.84	16.44	16.68	16.70
No dung	16.80	17.04	16.84	16.76	16.98	16.96	16.87
Dung	16.80	16.49	16.78	16.90	16.49	16.67	16.72
Mean	16.80	16.76	16.80	16.83	16.69	16.81	16.79

Standard errors (b) are for use in horizontal comparisons only, (a) and (c) for use in all other comparisons

Standard errors	(a)	(b)	(c)
Total sugar	±1.59	±2.93	±2.62

48/Bb/1.8

Series 4. Sugar Beet

	Superphosphate			Potash			Mean
	None	Ploughed in	In seed bed	None	Ploughed in	In seed bed	
Tops: tons per acre							
	(a)	(b)	(c)	(a)	(b)	(c)	
Shallow	17.86	17.14	16.40	16.83	18.21	17.40	17.32
Deep	19.39	21.51	19.39	18.97	21.84	19.91	19.92
No dung	18.15	17.65	17.21	17.58	18.62	17.39	17.79
Dung	19.10	21.00	18.58	16.22	21.43	19.92	19.44
Mean	18.62	19.33	17.90	17.90	20.02	18.65	18.62

Plant Number: thous. per acre

Shallow	18.7	18.3	18.9	18.5	18.9	18.7	18.7
Deep	18.2	17.4	18.0	16.2	17.7	17.7	17.9
No dung	18.1	18.0	18.1	18.1	18.1	18.0	18.1
Dung	18.7	17.7	18.8	18.5	18.5	18.4	18.5
Mean	18.4	17.9	18.4	18.3	18.3	18.2	18.3

Noxious Nitrogen

Shallow	42.2	40.2	41.0	40.2	44.0	41.2	41.4
Deep	46.4	46.2	46.2	45.1	48.0	47.0	46.3
No dung	43.1	41.8	44.0	42.8	43.5	43.0	43.0
Dung	45.5	44.6	43.2	42.6	48.5	45.2	44.8
Mean	44.3	43.2	43.6	42.7	46.0	44.1	43.9

Standard errors (b) are for use in horizontal comparisons only, (a) and (c) for use in all other comparisons.

Standard errors:	(a)	(b)	(c)
Tops	±0.326	±0.925	±0.730

48/Bb/1.9

Series 5. Barley

Residual effects

Responses to treatments.

	Mean	Ploughing		Dung		Super		Potash	
		Shallow	Deep	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.
Grain: Mean yield 40.9 cwt. per acre (± 0.60 , Means ± 0.42)									
Ploughing deep									
-shallow	0.2	-	-	1.4	-1.0	0.0	0.4	0.4	0.0
Dung	1.6	2.8	0.4	-	-	3.1	0.1	2.4	0.8
Superphosphate	1.3	1.1	1.5	2.8	-0.2	-	-	2.4	0.2
Potash	-1.0	-0.6	-1.2	-0.2	-1.8	0.1	-2.1	-	-

Straw: Mean yield 44.8 cwt. per acre

Ploughing deep									
-shallow	0.1	-	-	0.0	0.2	1.0	-0.8	-0.5	0.7
Dung	2.3	2.2	2.4	-	-	3.6	1.0	4.9	-0.3
Superphosphate	0.2	1.1	-0.7	1.5	-1.1	-	-	-1.0	1.4
Potash	0.2	-0.4	0.8	2.3	-2.4	-1.0	1.4	-	-

Series 6. Wheat

Residual effects

Responses to treatments

	Mean	Ploughing		Dung		Super		Potash	
		Shallow	Deep	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.
Grain: Mean yield 40.7 cwt. per acre (± 2.04 , Means ± 1.45)									
Ploughing deep									
-shallow	-3.5	-	-	-4.5	-2.5	-2.5	-4.5	-2.3	-4.7
Dung	2.2	1.2	3.2	-	-	2.3	2.1	4.5	-0.1
Superphosphate	0.7	1.7	-0.3	0.8	0.6	-	-	1.0	0.4
Potash	0.9	2.1	-0.3	3.2	-1.4	1.2	0.6	-	-

Straw: Mean yield 60.6 cwt. per acre

Ploughing deep									
-shallow	-3.4	-	-	-3.2	-3.6	-1.2	-5.6	-1.6	-5.2
Dung	2.7	2.9	2.5	-	-	3.3	2.1	5.3	-0.9
Superphosphate	0.2	2.4	-2.0	0.8	-0.4	-	-	-0.6	1.0
Potash	0.2	2.0	-1.6	3.8	-3.4	-0.6	1.0	-	-