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## Exhaustion Land Experiment plan and fertilizer treatments, Phase V, 2007 onwards

DOI: [10.23637/rex4-planV-01](https://doi.org/10.23637/rex4-planV-01)

**Cite as:** Rothamsted Research (2022) *Exhaustion Land Experiment plan and fertilizer treatments, Phase V, 2007 onwards*. Electronic Rothamsted Archive, Rothamsted Research, Harpenden, UK. [10.23637/rex4-planV-01](https://doi.org/10.23637/rex4-planV-01)

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**Published by:** Electronic Rothamsted Archive, Rothamsted Research, Harpenden, UK

**Date:** Created 2016, updated October 2022

**Description:** Plans and details of the fertilizer treatments applied to the Rothamsted Exhaustion Land Experiment, Phase V (2007 onwards), not to scale.

- **Page 1:** Cover page
- **Page 2:** Experiment overview, 1856-present day
- **Page 3:** Experiment plan Phase V, 2007 onwards
- **Page 4:** P and K inputs 1986-2022

**Site:** R/EX/4. Hoos Field, Rothamsted Experimental Farm, Rothamsted Research, West Common, Harpenden, Hertfordshire, AL5 2JQ, UK. Latitude 51.812883, Longitude -0.375931

### Derived from:

- Rothamsted (1991) *Guide to the Classical Field Experiments*, Rothamsted Experimental Station, Lawes Agricultural Trust, Harpenden UK DOI: [10.23637/ERADOC-1-189](https://doi.org/10.23637/ERADOC-1-189)
- Poulton, P. R., Johnston, A. E. and White, R. P. (2013) Plant-available soil phosphorus. Part I: the response of winter wheat and spring barley to Olsen P on a silty clay loam, *Soil Use and Management*, **29**: 4-11 DOI: [10.1111/j.1475-2743.2012.00450.x](https://doi.org/10.1111/j.1475-2743.2012.00450.x)
- Johnston, A. E. , Poulton, P. R. , White, R. P. and Macdonald, A. J. (2016) Determining the longer term decline in plant-available soil phosphorus from short-term measured values, *Soil Use and Management*, **32**, 151-161 DOI: [10.1111/sum.12253](https://doi.org/10.1111/sum.12253)

**Funding:** Rothamsted Research receives strategic funding from the UK Biotechnology and Biological Sciences Research Council (BBSRC). The Rothamsted Long-term Experiments National Capability is supported by the BBSRC Grant BBS/E/C/000J0300 and the Lawes Agricultural Trust.

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## Exhaustion Land Experiment overview

### Phase I

#### Plot numbers 'Smiths Wheat' experiment, 1856-1875

<b>V</b>	<b>IV</b>	<b>III</b>	<b>II</b>	<b>I</b>	<b>V</b>	<b>IV</b>	<b>III</b>	<b>II</b>	<b>I</b>
Nil	Nil	N	NPKNaMg	PKNaMg	Nil	Nil	N	NPKNaMg	PKNaMg

#### Plot numbers Potato experiment, 1876-1901

<b>1</b>	<b>3</b>	<b>5</b>	<b>7</b>	<b>9</b>	<b>2</b>	<b>4</b>	<b>6</b>	<b>8</b>	<b>10</b>
Nil	FYM	N	NPKNaMg	P	Nil	FYM	N*	N*PKNaMg	PKNaMg

### Phase II

← Unfertilized 1902-1939 →

### Phase III

← PK residues (Basal N) 1940-1975 →

All main plots divided into 4 sub-plots in 1976 with 4 N rates

← PK residues (Rates of N) 1976-1985 →

### Phase IV

1986-2006

"P Test"

Rates of P (Basal K & N) 1986-92

PK residues (Rates of N) 1986-91

"K Test"

K residues (Basal P & N) 1992-2006

No fresh P (Basal K & N) 1993-99

Maintenance P (Basal K & N) 2000- (except P0 plots)

### Phase V

2007-

"P Test"

Maintenance P (Basal K & N) 2000- (except P0 plots)

P withheld from residual P plots (P1) since 2016

"K Test"

Rates of K (Basal P & N) 2007-

### Cropping:

1856-1875 winter wheat; 1876-1901 potatoes.

1902-1991 spring barley most years, fallow in 1920, 1967 & 1975.

1992 onwards winter wheat (except 2001 when w wheat failed so re-sown to spring wheat)

## Exhaustion Land Experiment Plan

2007-

Phase V

↗ N

<b>Plot 10</b> 101 <b>K0</b>	<b>Plot 8</b> 081 <b>K0</b>	<b>Plot 6</b> 061 <b>K0</b>	<b>Plot 4</b> 041 <b>K0</b>	<b>Plot 2</b> 021 <b>K0</b>
102 <b>K0</b>	082 <b>K0</b>	062 <b>K0</b>	042 <b>K0</b>	022 <b>K0</b>
(PKNaMg) (1876-1901)	(N*PKNaMg) (1876-1901)	(N*) (1876-1901)	(FYM(N*P)) (1876-1901)	(Nil (FYM)) (1876-1901)
103 <b>K1</b>	083 <b>K1</b>	063 <b>K1</b>	043 <b>K1</b>	023 <b>K1</b>
104 <b>K2</b>	084 <b>K2</b>	064 <b>K2</b>	044 <b>K2</b>	024 <b>K2</b>
		<b>"K Test"</b>		
<b>Plot 9</b> 091 <b>P</b> <b>(P3)</b>	<b>Plot 7</b> 071 <b>P</b> <b>(P3)</b>	<b>Plot 5</b> 051 <b>P</b> <b>(P3)</b>	<b>Plot 3</b> 031 <b>P</b> <b>(P3)</b>	<b>Plot 1</b> 011 <b>P</b> <b>(P3)</b>
092 <b>(P2)</b> <b>P</b> (P)	072 <b>(P2)</b> <b>P</b> (NPKNaMg)	052 <b>(P2)</b> <b>P</b> (N)	032 <b>(P2)</b> <b>P</b> (FYM(P))	012 <b>(P2)</b> <b>P</b> (Nil)
(1876-1901) 093 <b>P</b> <b>(P1)</b>	(1876-1901) 073 <b>P</b> <b>(P1)</b>	(1876-1901) 053 <b>P</b> <b>(P1)</b>	(1876-1901) 033 <b>P</b> <b>(P1)</b>	(1876-1901) 013 <b>P</b> <b>(P1)</b>
094 <b>(P0)</b> <b>Nil</b>	074 <b>(P0)</b> <b>Nil</b>	054 <b>(P0)</b> <b>Nil</b>	034 <b>(P0)</b> <b>Nil</b>	014 <b>(P0)</b> <b>Nil</b>
		<b>"P Test"</b>		

(not to scale)

### Annual Treatments per hectare, 2007-:

#### "K Test" (Plots 2,4,6,8 and 10)

K0: Nil

K1: 62.2 kg K as muriate of potash

K2: 124.5 kg K as muriate of potash

Basal manuring to all plots:

300 kg N & 20 kg P (15 kg P since 2009) each year, and 20 kg Mg every three years

(12 kg Mg annually since 2009).

#### "P Test" (Plots 1,3,5,7 and 9) since 2000: 'Maintenance' P to all plots, except Nil

Nil: No fertilizer or manure

P: 20 kg P as triple superphosphate in autumn 2007-8; 15 kg P 2009-

P has not been applied to plots 013,033,053,073 & 093 since 2016 (autumn 2015).

Basal manuring to all plots:

300 kg N & 124.5 kg K each year, and 20 kg Mg every three years (12 kg Mg annually since 2009).

**Cropping:** Winter wheat 2007 onwards

### Annual Treatments per hectare, 1986-1992:

(P0): No P

(P1): 44 kg P as triple superphosphate

(P2): 87 kg P as triple superphosphate

(P3): 131 kg P as triple superphosphate

### Annual Treatments per hectare, 1856-1901, Phase I:

Nil : No fertilizer or manure

FYM : 35 of farmyard manure since 1876

Nil (FYM) : FYM 1876-1881, no fertilizer or manure 1882-1901

FYM (P) : FYM plus P 1876-1882, FYM only 1883-1901

FYM (N\*P) : FYM plus N\* and P 1876-1881, FYM plus P 1882, FYM only 1883-1901

N : 96 kg N as ammonium salts (ammonium sulphate & ammonium chloride)

N\* : 96 kg N as sodium nitrate

P : 34 kg P (as superphosphate 1856-96, from basic slag 1897-1901)

K : 137 kg K as potassium sulphate (91 kg K 1859-74)

Na : 16 kg Na as sodium sulphate

Mg : 11 kg Mg as magnesium sulphate

## Exhaustion Land P and K inputs 1986 onwards

Main plots Sub-plot	P Test plots 01, 03, 05, 07, 09					K Test plots 02, 04, 06, 08, 10					Notes
	04	03	02	01	All plots	01	02	03	04	All plots	
Harvest year	kg P/ha				kg K/ha	kg K/ha				kg P/ha	
					Basal K					Basal P	
1986	0	44	87	131	83	0	0	0	0	0	"P Test" started; basal K added
1987	0	44	87	131	83	0	0	0	0	0	
1988	0	44	87	131	83	0	0	0	0	0	
1989	0	44	87	131	83	0	0	0	0	0	
1990	0	44	87	131	83	0	0	0	0	0	
1991	0	44	87	131	83	0	0	0	0	0	
1992	0	44	87	131	83	0	0	0	0	437	Large P applications to "K Test" start so that P is not limiting
1993	0	0	0	0	83	0	0	0	0	131	Applications of P to "P Test" plots withheld
1994	0	0	0	0	83	0	0	0	0	65.4	
1995	0	0	0	0	83	0	0	0	0	65.4	
1996	0	0	0	0	85	0	0	0	0	65.4	
1997	0	0	0	0	83	0	0	0	0	65.4	
1998	0	0	0	0	83	0	0	0	0	65.4	
1999	0	0	0	0	83	0	0	0	0	22	Basal P on "K Test" plots reduced
2000	0	61.5	61.5	61.5	124.5	0	0	0	0	61.5	P treatments were applied at 61.5 kg P in error in 2000.
2001	0	20	20	20	124.5	0	0	0	0	20	
2002	0	20	20	20	124.5	0	0	0	0	20	
2003	0	20	20	20	124.5	0	0	0	0	20	
2004	0	20	20	20	124.5	0	0	0	0	20	
2005	0	20	20	20	124.5	0	0	0	0	20	
2006	0	20	20	20	124.5	0	0	0	0	20	
2007	0	20	20	20	124.5	0	0	62.3	124.5	20	Fresh K added to some "K Test" plots
2008	0	20	20	20	124.5	0	0	62.3	124.5	20	
2009	0	15	15	15	124.5	0	0	62.3	124.5	15	Maintenance P application reduced
2010	0	15	15	15	124.5	0	0	62.3	124.5	15	
2011	0	15	15	15	124.5	0	0	62.3	124.5	15	
2012	0	15	15	15	124.5	0	0	62.3	124.5	15	
2013	0	15	15	15	124.5	0	0	62.3	124.5	15	
2014	0	15	15	15	124.5	0	0	62.3	124.5	15	
2015	0	15	15	15	124.5	0	0	62.3	124.5	15	
2016	0	0	15	15	124.5	0	0	62.3	124.5	15	Maintenance P application to old P1 treatment stopped.
2017	0	0	15	15	124.5	0	0	62.3	124.5	15	
2018	0	0	15	15	124.5	0	0	62.3	124.5	15	
2019	0	0	15	15	124.5	0	0	62.3	124.5	15	
2020	0	0	15	15	124.5	0	0	62.3	124.5	15	
2021	0	0	15	15	124.5	0	0	62.3	124.5	15	
2022	0	0	15	15	124.5	0	0	62.3	124.5	15	
Total input	0	634.5	1040.5	1348.5	4027.5	0	0	996.8	1992	1348.5	