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Summary of the fertilizer, manure and cropping treatments applied to the Broadbalk Experiment.

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Description: The Broadbalk Experiment was started in the autumn of 1843, with the first crop harvested in 1844. 20 STRIPS extending the length of the field are given different fertilizer and manure treatments. From 1926 the strips were divided into SECTIONS with different cropping and fallowing. This document summarizes the different fertilizer, manure and cropping treatments, and gives details of the changes to the strip and section names. Each PLOT is a unique strip\section combination.

- **Pages 1-2:** Cover Pages
- **Pages 3-4:** Fertilizer and manure treatments applied to the different STRIPS since 1852, with timeline of changes to strip names and treatments.
- **Page 5:** Divisions of the strips into different SECTIONS, with timeline of cropping and fallowing and changes to section names.

Site: R/BK/1. Broadbalk field, Rothamsted Experimental Farm, Rothamsted Research, West Common, Harpenden, Hertfordshire, AL5 2JQ, UK.

Geographic location: 51.80946 -0.37301

Derived from:

- Rothamsted Experimental Station (1970) *Details of the Classical and Long-Term Experiments up to 1967*, Rothamsted Experimental Station, Lawes Agricultural Trust, Harpenden UK, (128 pp) <http://doi.org/10.23637/ERADOC-1-192>
- Rothamsted (1977) *Details of the Classical and Long-Term Experiments 1968-1973*, Rothamsted Experimental Station, Lawes Agricultural Trust, Harpenden UK, (77pp) DOI: <https://doi.org/10.23637/ERADOC-1-193>

- Johnston, A. E. and Garner, H. V. (1969) Broadbalk: Historical Introduction, Rothamsted Experimental Station Report for 1968, Part 2, (12-25)
DOI: <https://doi.org/10.23637/ERADOC-1-34916>
- Poulton, P.R. et al. (2025) The Broadbalk Wheat Experiment, Rothamsted, UK: Crop yields and soil changes during the last 50 years", *Advances in Agronomy* **184**, 173-298 <https://doi.org/10.1016/bs.agron.2023.11.003>

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Timeline of Broadbalk strip fertilizer and manure treatments since 1852. Table shows **changes** to strip names and treatments, treatment details are on the next page.

Strip	Sections	1852-1864	1865-1893	1894-1925	1926-1967	1968-1984	1985-2000	2001-2020	2021-	
01	2-7	[area previously unmanured, Strip 1 started in 1968]				1 FYM N2PK	FYM N4PK	(FYM) N4		
2.1	0-9	[half area received KNaMg 1844-1883, half area unmanured since 1844]		2A FYM since 1885		2.1 (shown as 21 in datasets) FYM N2		FYM N3 (since 2005)		
2.2	0-9	2 FYM		2B FYM		2.2 (shown as 22 in datasets) FYM				
03	0-9	3 Nil since 1839		3 Nil [strips 3 and 4 combined in 1899]		Nil				
04	0-9	4 Nil (NP 1844-1851)								
05	0-9	5 PKNaMg				PK(Na)Mg	PKMg	(P)KMg		
06	0-9	6 N1PKNaMg				N1PK(Na)Mg	N1PKMg	N1(P)KMg		
07	0-9	7 N2PKNaMg				N2PK(Na)Mg	N2PKMg	N2(P)KMg		
08	0-9	8 N3PKNaMg				N3PK(Na)Mg	N3PKMg	N3(P)KMg		
09	0-9	9a N1* until 1854; N2*PKNaMg until 1884	9a N1*PKNaMg 1885-1893	9 N1*PKNaMg since 1894		N4PK(Na)Mg	N4PKMg	N4(P)KMg		
		9b N*2 until 1884	9b N*1 1885-1893							
10	0-9	10 N2							N4	
11	0-9	11 N2P							N4P Mg	N4(P*) Mg
12	0-9	12 N2P Na*							N1+3+1 (P)K(Na*)Mg ¹	
13	0-9	13 N2PK							N4PK	N4(P*)K
14	0-9	14 N2P Mg*				N2PK Mg*		N4PK*(Mg*)	N4(P*)K*(Mg*)	
15	0-9	15a N2PKNaMg	15 N2PKNaMg since 1874			N3PK(Na)Mg	N5PKMg	N5(P)KMg		
		15b N1.5PKNaMg +C until 1873								
16	0-9	16 N4PKNaMg	Nil 1865-1883	N2*PKNaMg since 1884		N2PK(Na)Mg	N6PKMg	N6(P)KMg		
17	0-9	17 N2 in even years, PKNaMg in odd years ²				N2 ½[PK(Na)Mg] ²	N0+3 ½[PKMg] ² from 1980		N1+4+1 PKMg	
18	0-9	18 N2 in odd years, PKNaMg in even years ²				N2 ½[PK(Na)Mg] ²	N1+3 ½[PKMg] ² from 1980		N1+2+1 PKMg	
19	0-9	19 half strip N1.5P +C until 1878	half strip C until 1903	full strip since 1904 C (other half strip previously unmanured)		C	(C) ³		N1+1+1 KMg	
20	0-1	[area previously unmanured, Strip 20 started in 1906]			20 N2 KNaMg since 1906		N2 K(Na)Mg	N2 KMg	N4 KMg	

¹ Strip 12 N1+3+1 (P)K2Mg2 2001-2005

² Treatments to strips 17 and 18 alternating each year. From 1968 both strips received N2 and ½ rate PK(Na)Mg. From 1980 to 2000 wheat on strips 17 and 18 received N1+3 i.e. autumn N1 in alternate years plus N3 in spring. Other crops did not receive autumn N.

³ Castor bean meal applied until 1988 to strip 19

Previously unmanured means no NPKNaMg fertilizer, FYM or C applied

The fertilizer treatments varied in 1843-1851 to test specific questions but were mainly established by 1852. See Lawes and Gilbert (1864) for details of the earlier treatments. Much of this background information taken from Johnston and Garner (1969).

- Lawes, J. B. & Gilbert, J. H. (1864) "Report of experiments on the growth of wheat, for twenty years in succession on the same land", *Journal of the Royal Agricultural Society of England*, **25**, (Part I and II), 93-185 Part I 449-501 Part II
- Johnston, A. E. & Garner, H. V. (1969) "Broadbalk: Historical Introduction", *Rothamsted Experimental Station Report for 1968*, **Part 2**, 12-25 [10.23637/ERADOC-1-34916](https://www.era.rothamsted.ac.uk/experiment/rbk1#documents/)

See also **Broadbalk plans and details of fertilizer treatments for more details:** <https://www.era.rothamsted.ac.uk/experiment/rbk1#documents/>

Annual treatments per hectare. Year refers to the harvest year.

FYM	35 t farmyard manure (from cattle)
(FYM)	35 t farmyard manure (from cattle) 1968-2000 only
Nil	No fertilizer or manure applied (unmanured)
C	Rape cake 1852-1940 supplying approx. 96 kg N (N2) Castor bean meal 1941-1988, supplying approx. 96 kg N (N2)
(C)	Castor bean meal to supply 96 kg N until 1988
P	35 kg P as triple superphosphate (superphosphate 1852-1967)
(P)	35 kg P as triple superphosphate until 2000; not applied since 2000 due to high levels in soil, reviewed annually
(P*)	35 kg P as triple superphosphate until 2020; not applied since 2020 due to high levels in soil, reviewed annually
K	90 kg K as potassium sulphate
K2	180 kg K as potassium sulphate, 2001-2005 strip 12 (plus 450kgK in autumn 2000 only)
K*	90 kg K as potassium chloride
Na	16 kg Na as sodium sulphate until 1973
Na*	55 kg Na as sodium sulphate (57kgNa until 1973) on strip 12 until 2000
(Na)	16 kg Na as sodium sulphate until 1973
(Na*)	55 kg Na as sodium sulphate (57kgNa until 1973) on strip 12 until 2000
Mg	11 kg Mg as magnesium sulphate until 1973, 35kgMg as Kieserite (magnesium sulphate monohydrate) every third year 1974-2000, 12 kg Mg as Kieserite since 2001
Mg2	24 kg Mg as Kieserite, 2001-2005 strip 12 (plus 60 kg Mg in autumn 2000 only)
Mg*	31 kg Mg as magnesium sulphate until 1973, 30 kg Mg as Kieserite 1974-2000
(Mg*)	31 kg Mg as magnesium sulphate until 1973, 30 kg Mg as Kieserite 1974-2000

Sulphur (S) has been added by default (except on strip 14 since 2001) as part of the potassium sulphate, magnesium sulphate, Kieserite, FYM and ammonium sulphate applications. S last applied to strip 14 in 2000.

Nitrogen: annual treatments kg N per hectare

N0	N1	N1.5	N2	N3	N4	N5	N6
0	48	72	96	144	192	240	288

N as ammonium sulphate until 1967, as calcium ammonium nitrate 1968-1985 and ammonium nitrate since 1986

N1*	N2*
48	96

N as sodium nitrate, 1852-1967 only

Split N to wheat (applied mid-March, mid-April, mid-May)

N1+1+1	48+48+48 (strip 19)
N1+2+1	48+96+48 (strip 18)
N1+3+1	48+144+48 (strip 12)
N1+4+1	48+192+48 (strip 17)

Alternating strips 17 and 18, 1980-2000 (autumn N to wheat only)

N0+3	0 in autumn +144 in spring
N1+N3	48 in autumn + 144 in spring

No fertilizer or manure to fallow 1926-1967

No N to fallow, but FYM, castor meal and PK etc as usual, 1968 onwards

No N or FYM to oats 1996-2017

From 2018 N to oats at ½ rate as a single application (mid-April)

No N or FYM to beans from 2018.

Timeline of Broadbalk strip divisions and Sections since 1843 and changes to cropping.

The Broadbalk Wheat Experiment was started in the autumn in 1843, with the first crop harvested in 1844. 20 **STRIPS** extending the length of the field are given different fertilizer and manure treatments. Most strips were usually harvested in two halves, 1846-1925 though the splits were not strict across those years and were sometimes combined. From 1926 the strips were divided into different **SECTIONS** with different cropping/fallowing. In 1968 the experiment was divided into 10 Sections, to allow the comparison of wheat grown continuously with wheat grown in rotation with other arable crops. Each **PLOT** is a unique strip\section combination.

Harvest year:						
1844-1845	1846-1893		1894-1925	1926-1954	1955-1967	1968 onwards
	strips divided lengthways		most strips divided in most years	Sections bare fallowed in sequence with wheat to control weeds.	Sections I and V divided	10 sections, winter wheat grown continuously or in rotation with other arable crops
No division of strips	a	b	T (top)	I Fallow one year in five since 1931	IA Continuous wheat since 1951	0 Continuous wheat, straw incorporated since 1986
					IB Fallow one year in five	1 Continuous wheat
				II Fallow one year in five since 1932		2 Rotation
				III Fallow one year in five since 1935		3 Rotation
			IV Fallow one year in five since 1934		4 Rotation	
					5 Rotation	
			V Fallow one year in five since 1933		6 Continuous wheat since 1978, no spring or summer fungicides	
					7 Rotation	
		8 Continuous wheat no herbicides, occasional fallowing				
		9 Continuous wheat				

Summary from Glendining, M.J., Poulton, P.R. and Macdonald, A.J. (2021) Broadbalk Wheat Experiment cropping 1843-2021. *Electronic Rothamsted Archive, Rothamsted Research*. <https://doi.org/10.23637/rbk1-crop1843-2021-01>

See also plans:

1852-1925: <https://doi.org/10.23637/rbk1-sup-1534342858-02>

1926-1967: <https://doi.org/10.23637/rbk1-plan1926-67-02>

1968-2017: <https://doi.org/10.23637/rbk1-plan1968-2017-01>

2018 onwards: <https://doi.org/10.23637/rbk1-today2018-02>