Broadbalk Wheat Experiment plan and cropping 1968-2017

Cite as: Rothamsted Research (2021) *Broadbalk Wheat Experiment plan and cropping 1968-2017*. *Electronic Rothamsted Archive, Rothamsted Research, Harpenden, UK*. https://doi.org/10.23637/rbk1-plan1968-2017-01

Prepared by: Glendining, M.J., Rothamsted Research, Harpenden, Herts, AL5 2JQ, UK.

Published by: Electronic Rothamsted Archive, Rothamsted Research

Date: June 2021, revised December 2023.

Description: Experiment plan for the Broadbalk Wheat Experiment, showing fertilizer and manure treatments and crop rotations and the Broadbalk Wilderness (not to scale), 1968-2017.

- **Page 1:** Cover page
- **Page 2:** Broadbalk Wheat Experiment plan showing plot layout, fertilizer and manure treatments, and the Broadbalk Wilderness. Plans shows crop rotations from 1996 and fertilizer treatments from 2006.
- **Pages 3-4:** Fertilizer and organic manure treatments 1968-2017, with details of the type and amount of fertilizer applied.
- **Pages 5-6:** Cropping details 1968-2017, showing sections, wheat cultivars and the different rotations.

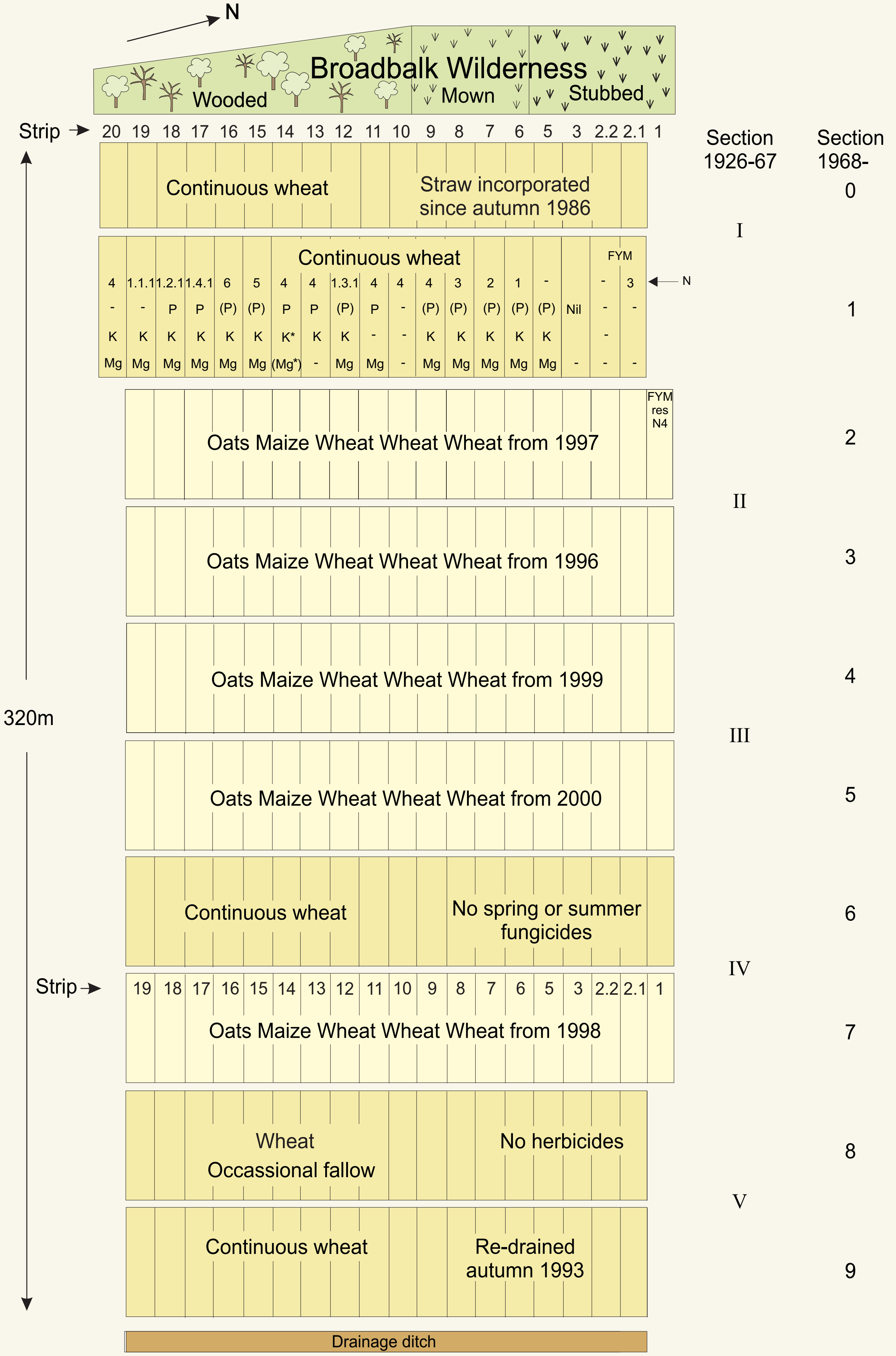
Site: R/BK/1. Broadbalk field, Rothamsted Experimental Farm, Rothamsted Research, West Common, Harpenden, Hertfordshire, AL5 2JQ, UK. Latitude 51.80946, Longitude -0.37301

Derived from:

- Rothamsted_Research (2006) *Guide to the Classical and other Long-term Experiments, Datasets and Sample Archive*, Rothamsted Research, Lawes Agricultural Trust Ltd, Harpenden UK. 10.23637/ROTHAMSTED-LONG-TERM-EXPERIMENTS-GUIDE-2006

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.

BROADBALK



Treatments from 2006

Broadbalk Fertilizer and organic manure treatments 1968-2017

Strip	1968-1984	1985-2000	2001-2005	2006-2017
01	FYM N2 PK	FYM N4 PK	(FYM) N4	(FYM) N4
2.1	FYM N2	FYM N2	FYM N2	FYM N3 (since 2005)
2.2	FYM	FYM	FYM	FYM
03	Nil	Nil	Nil	Nil
05	PK(Na)Mg	PKMg	(P)KMg	(P)KMg
06	N1 PK(Na)Mg	N1 PKMg	N1 (P)KMg	N1 (P)KMg
07	N2 PK(Na)Mg	N2 PKMg	N2 (P)KMg	N2 (P)KMg
08	N3 PK(Na)Mg	N3 PKMg	N3 (P)KMg	N3 (P)KMg
09	N4 PK(Na)Mg	N4 PKMg	N4 (P)KMg	N4 (P)KMg
10	N2	N2	N4	N4
11	N2 P	N2 P	N4 P Mg	N4 P Mg
12	N2 PNa	N2 PNa	N1+3+1 (P)K2Mg2	N1+3+1 (P)KMg
13	N2 PK	N2 PK	N4 PK	N4 PK
14	N2 PKMg*	N2 PKMg*	N4 PK*(Mg*)	N4 PK*(Mg*)
15	N3 PK(Na)Mg	N5 PKMg	N5 (P)KMg	N5 (P)KMg
16	N2 PK(Na)Mg	N6 PKMg	N6 (P)KMg	N6 (P)KMg
17	N2 1/2[PK(Na)Mg]	N0+3 1/2[PKMg](A)	N1+4+1 PKMg	N1+4+1 PKMg
18	N2 1/2[PK(Na)Mg]	N1+3 1/2[PKMg](A)	N1+2+1 PKMg	N1+2+1 PKMg
19	C	(C)	N1+1+1 KMg	N1+1+1 KMg
20	N2 K(Na)Mg	N2 KMg	N4 KMg	N4 KMg

(A) Treatment to strips 17 & 18 alternating each year. From 1968 both strips received N2 and half-rate PK(Na)Mg; from 1980 wheat on strips 17 & 18 received N1+3 ie autumn N1 in alternate years plus N3 in spring. Other crops did not receive autumn N.

Annual treatment per hectare

FYM : Farmyard manure (from cattle) at 35t
(FYM) : Farmyard manure at 35t 1968-2000 only
P : 35kgP as triple superphosphate
(P) : 35kgP as triple superphosphate until 2000; not applied since 2000 due to high levels of soil P, reviewed annually since 2000.
K : 90kgK as potassium sulphate
K2 : 180kgK as potassium sulphate, 2001-2005. (plus 450 kgK in autumn 2000 only)
K* : 90kgK as potassium chloride
Mg : 12kgMg as Kieserite.Was 35kgMg every 3rd year 1974-2000.Previously 11kgMg as magnesium sulphate until 1973
Mg2 : 24kgMg as Kieserite, 2001-2005. (plus 60 kg Mg in autumn 2000 only)
(Mg*) : 30kgMg as Kieserite 1974-2000.Previously 31kgMg as magnesium sulphate until 1973
(Na) : 16kgNa as sodium sulphate until 1973; 55kgNa on strip 12 only until 2000 (57kgNa until 1973)
(C) : Castor meal to supply 96kgN until1988

N to wheat as single applications (mid-April)
N1,N2,N3,N4,N5,N6 : 48,96,144,192,240,288 kgN

Split N to wheat (mid-Mar, mid-Apr, Mid-May)
N1+1+1 : 48+48+48 kgN (strip 19)
N1+2+1 : 48+96+48 kgN (strip 18)
N1+3+1 : 48+144+48 kgN (strip 12)
N1+4+1 : 48+192+48 kgN (strip 17)

Split N to forage maize, 1997-2017, (seedbed and post-emergence):
N2+1 : 96+48 kgN (strip 19)
N2+2 : 96+96 kgN (strip 18)
N2+3 : 96+144 kgN (strip 12)
N2+4 : 96+192 kgN (strip 17)

S (sulphur) has been added, by default, as part of the potassium sulphate, magnesium sulphate, Keiserite, FYM and ammonium sulphate applications.
S has not been applied to plot 14 from 2001 onwards.

N applied as ammonium nitrate (Nitram,34.5%N) since 1986;
as calcium ammonium nitrate (Nitro-chalk,21-27.5%N) 1968-85;
as ammonium salts until 1967 except N* which was sodium nitrate

No N or FYM to oats, 1996-2017
From 1968-1996, beans and potatoes received N, FYM (and PK etc) at the same rate as wheat.

Fallow management:
From autumn 1967 onwards, FYM and the autumn fertilisers (P,K, Na, Mg and Castor meal) were applied to the fallow sections of the rotational sections (and Section 8 when fallowed).
N was NOT applied.
This is in contrast to the management of the fallow sections 1926-1967, when no fertilisers or manures were applied to those sections which were fallowed to control weeds in the continuous wheat sections.

Broadbalk Cropping 1968-2017

1st wheat shown in yellow

New section number

Wheat cultivar	Harvest Year	Continuous wheat					Rotational wheat				
		1	9	0"	8*	6**	5	3	7	4	2
Cappelle Desprez	1968	W	W	W	W	F	W	W	P	W	BE
Cappelle Desprez	1969	W	W	W	W	W	F	W	BE	P	W
Cappelle Desprez	1970	W	W	W	W	W	W	F	W	BE	P
Cappelle Desprez	1971	W	W	W	W	F	W	W	P	W	BE
Cappelle Desprez	1972	W	W	W	F	W	F	W	BE	P	W
Cappelle Desprez	1973	W	W	W	W	W	W	F	W	BE	P
Cappelle Desprez	1974	W	W	W	W	F	W	W	P	W	BE
Cappelle Desprez	1975	W	W	W	W	W	F	W	BE	P	W
Cappelle Desprez	1976	W	W	W	W	W	W	F	W	BE	P
Cappelle Desprez	1977	W	W	W	W	F	W	W	P	W	BE
Cappelle Desprez	1978	W	W	W	W	W	F	W	BE	P	W
Flanders	1979	W	W	W	W	W	W	F	W	P	F
Flanders	1980	W	W	W	W	W	W	W	F	W	P
Flanders	1981	W	W	W	F	W	W	W	P	F	W
Flanders	1982	W	W	W	W	W	W	W	W	P	F
Flanders	1983	W	W	W	W	W	W	W	F	W	P
Flanders	1984	W	W	W	W	W	W	W	P	F	W
Brimstone	1985	W	W	W	W	W	F	W	W	P	W
Brimstone	1986	W	W	W	W	W	P	F	W	W	W
B & SHM*	1987	W	W	W	W	W*	W	P	W	W	F
B & SHM*	1988	W	W*	W	F	W*	W	W*	F	W	P
B & SHM*	1989	W	W*	W	W	W*	W	W	P	F	W*
B & SHM*	1990	W	W*	W	W	W*	F	W	W*	P	W
Apollo	1991	W	W	W	W	W	P	F	W	W	W
Apollo	1992	W	W	W	W	W	W	P	W	W	F
Apollo	1993	W	W	W	W	W	W	W	F	W	P
Apollo	1994	W	W	W	F	W	W	W	P	F	W
Apollo	1995	W	W	W	W	W	F	W	W	P	W
Hereward	1996	W	W	W	W	W	P	O	W	W	W
Hereward	1997	W	W	W	W	W	W	M	W	W	O
Hereward	1998	W	W	W	W	W	W	W	O	W	M
Hereward	1999	W	W	W	W	W	W	W	M	O	W
Hereward	2000	W	W	W	W	W	O	W	W	M	W
Hereward	2001	W	W	W	F	W	M	O	W	W	W
Hereward	2002	W	W	W	W	W	W	M	W	W	O
Hereward	2003	W	W	F	W	W	W	W	O	W	M
Hereward	2004	W	W	F	W	W	W	W	M	O	W
Hereward	2005	W	W	W	W	W	O	W	W	M	W
Hereward	2006	W	W	W	W	W	M	O	W	W	W
Hereward	2007	W	W	W	W	W	W	M	W	W	O
Hereward	2008	W	W	W	F	W	W	W	O	W	M
Hereward	2009	W	W	W	W	W	W	W	M	O	W
Hereward	2010	W	W	W	W	W	O	W	W	M	W
Hereward	2011	W	W	W	W	W	M	O	W	W	W
Hereward	2012	W	W	W	W	W	W	M	W	W	O
Crusoe[a]	2013	W	W	W	W	W	W	W	O	W	M

Crusoe	2014	W	W	W	W	W	W	W	M	O	W
Mulika[b]	2015	W	W	W	F	W	O	W	W	M	W
Crusoe	2016	W	W	W	F	W	M	O	W	W	W
Crusoe	2017	W	W	W	W	W	W	M	W	W	O

W=winter wheat, P=potatoes, BE=spring beans, F=fallow, O=winter oats, M=forage maize

"straw incorporated since autumn 1986 *no herbicides **no spring or summer fungicides since 1985

Section 0 fallowed in 2003 and 2004 in an attempt to control *Equisetum* and test various herbicides

B & SHM* comparison of modern variety Brimstone and old variety Squarehead's Master, except on FYM plots

Brimstone in all other sections 1985-1990

[a] variety changed to Crusoe in 2013, but sown very late, due to a wet autumn and winter.

[b] spring wheat variety Mulika sown in 2015, as wet autumn and winter prevented sowing of winter wheat.

Winter wheat varieties selected primarily for their yield potential, and also their suitability for breadmaking.

Continuous wheat: Sections 0, 1, 6, 8 and 9

Section 0 has straw incorporated since 1986

Section 8 has no herbicides, so yields are restricted by weeds. It is fallowed frequently.

Section 6 was in a wheat/wheat/fallow rotation until 1979 and has restricted fungicide use.

Rotational wheat: Sections 2, 3, 4, 5 and 7

These Sections grow wheat in rotation with other arable crops (potatoes, maize, oats, beans & fallow).

Between 1968 and 1980 sections 3, 5 and 6 had a three year rotation of wheat/wheat/fallow.

Section 6 then became continuous wheat.

Between 1968 and 1978 sections 2, 4 and 7 had a three year rotation of wheat/potato/beans.

In 1979 this changed to a three year rotation of fallow/potato/wheat until 1984.

From around 1985 all sections changed to a five year rotation of wheat/wheat/wheat/fallow/potato until around 1996, then wheat/wheat/wheat/oats/maize until 2017.

Changes to rotation indicated by a thick line.

To select 1st wheat yields, eg Section 7, 1970, in the Data Extraction Tool select Yr-of-wheat = 1

To select 2nd wheat yields, eg Section 7, 1986, in the Data Extraction Tool select Yr-of-wheat = 2

To select 3rd wheat yields, eg Section 7, 1987, in the Data Extraction Tool select Yr-of-wheat = 3

Other crop cultivars

Spring field beans (*Vicia faba):* 1968-1978: Maris Bead (1968-74); Minor (1975) Minden (1976-78)

Potato (*Solanum tuberosum*) 1968-1996: Majestic (1968-69); King Edward (1970-75); Pentland Crown (1976-93); Estima (1994-96).

Forage maize (*Zea mays*) whole crop for silage: 1997-2017: Hudson (1997-2014); Severus (2015-2017)

Yields may have been reduced due to the accidental application of herbicide to the crop in June/July 2013

Winter oats (*Avena sativa*) 1996 onwards: Image (1996-2000); Revisor (2001), Gerald (2002 onwards)