



The Woburn Ley-arable experiment cropping sequence 1938 - 2020

ROTHAMSTED
RESEARCH

DOI: [10.23637/wrn3-cropping1938-2020-02](https://doi.org/10.23637/wrn3-cropping1938-2020-02)

Cite as: Poulton, P.R., Johnston, A.E., Macdonald, A.J., Glendining, M.J. and Ostler, R. J. (2022) *Woburn Ley-arable experiment cropping 1938-2020. Electronic Rothamsted Archive, Rothamsted Research.* <https://doi.org/10.23637/wrn3-cropping1938-2020-02>

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

Date: November 2021, updated November 2022 to include rotation database, with different crops and cultivars

Description: Details of the arable and ley rotation sequences in each of the five Blocks, and the different treatment crops, 1938-2020.

- **Page 1:** Cover page
- **Page 2:** Generic plan showing plot and block layout and dimensions
- **Page 3:** Treatment code summary
- **Page 4:** Woburn Ley-arable cropping sequence Blocks I – V, 1938-1972/6
- **Page 5:** Woburn Ley-arable cropping sequence Blocks I – V, 1973-2007/11
- **Page 6:** Woburn Ley-arable cropping sequence Blocks I – V, 2008-2020

Site: W/RN/3. Stackyard field, Woburn Experimental Farm, Husborne Crawley, Woburn, Bedfordshire, UK. Geographic location: 51.99906, -0.61673

Derived from:

- Rothamsted Experimental Station (1966) *Details of the Classical and Long-term experiments up to 1962*. Lawes Agricultural Trust, Harpenden. pp. 87 <https://doi.org/10.23637/ERADOC-1-191>
- 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 <https://doi.org/10.23637/ERADOC-1-192>
- Rothamsted Experimental Station (1978) *Details of the Classical and Long-term experiments 1968-73*. Lawes Agricultural Trust, Harpenden. pp. 77 <https://doi.org/10.23637/ERADOC-1-193>
- Johnston, A.E., Poulton, P.R., Coleman, K., Macdonald, A.J. & White, R.P. (2017) Changes in soil organic matter over 70 years in continuous arable and ley-arable rotations on a sandy loam soil in England. *European Journal of Soil Science*, 68, 305-316. <https://doi.org/10.1111/ejss.12415>

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.

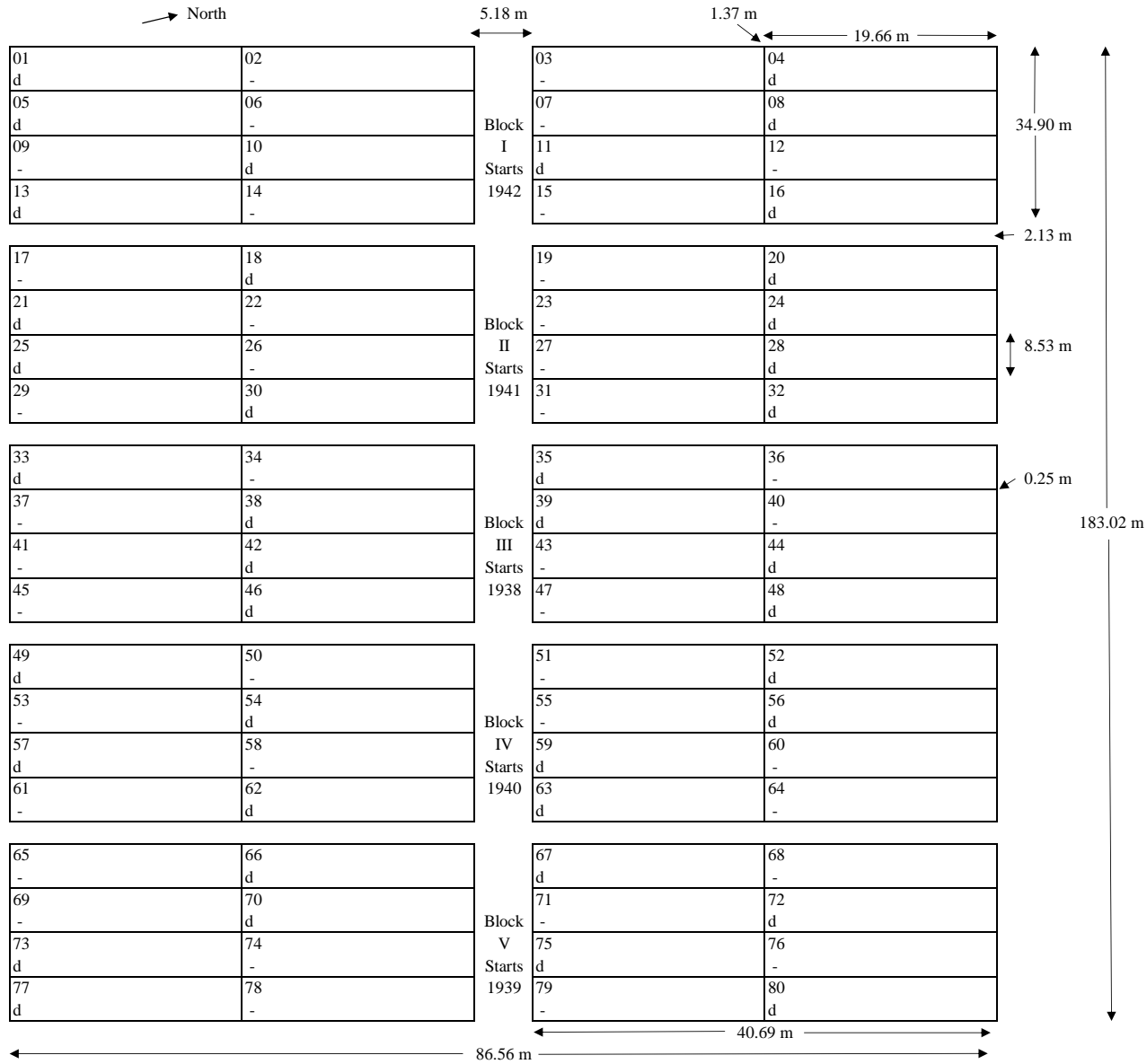
Licence and conditions of re-use:



These details are published under [the Creative Commons Attribution 4.0 International](https://creativecommons.org/licenses/by/4.0/) licence. CC BY 4.00

You are free to adapt, copy, redistribute these details but must provide appropriate credit using the provided citation, including the DOI and indicate any changes made. You must not apply additional restrictions on the licence.

Generic plan of the Woburn Ley-arable experiment



d = plots receiving dung (FYM) every five years until the mid-1960s.

Woburn Ley-arable Treatment codes summary

Rotation ²	Date started ¹							
	1938-42	1964-67	1971-74	1973-77	1978-82	1998-2002	2007	2008-12
Continuous rotations	Ar			AF		AM		AO
	Ah			AB		ABe		ABe*
	L			Ln3				Ln3
	Lu	S	CL	Lc3				Lc3
Alternating rotations	Ar/Lu	Ar/S	Ar/CL	1st cycle 8-yr leys	LLn8		8-yr leys stopped	LLn/AO
	Ah/L				LLc8			LLc/ABe*
	Lu/Ar	S/Ar	CL/Ar	2nd cycle 8-yr leys		LLn8	8-yr leys stopped	LLn/Ln3
	L/Ah					LLc8		LLc/Lc3

¹Date started showed as a range, as changes to cropping generally phased in over five years, starting with Block III, followed by Blocks V, IV, II and I. The exception is when the 1st cycle 8-yr leys stopped and all changed to continuous arable (AO or ABe) in 2007.

²At the start of the experiment, plots were in either Continuous Rotations or Alternating Rotations.

1938-1974

Continuous rotations

Ar three arable Treatment crops, including one year root crop, followed by two arable Test crops
Ah three arable Treatment crops, including one year hay, followed by two arable Test crops
L three year grazed grass-clover ley Treatment crops, followed by two arable Test crops.
Lu three year lucerne ley Treatment crops, followed by two arable Test crops. **Lu** (lucerne) then **S** (sainfoin) 1964-67 then **CL** (red clover ley) 1971-74
The **Alternating Rotations** were designated as either **Ar/Lu**, **Ah/L**, **Lu/Ar** or **L/Ah** according to the order in which the first six Treatment crops appeared. They alternated between the two arable and two ley-arable rotations, eg Ar, Lu, Ah, L, taking 20 years to complete the cycle.

1973-2002

AF (replaced Ar); two years fallow and one arable Treatment crop, followed by two arable Test crops. This changed to **AM**
AB (replaced Ah); three arable Treatment crops, followed by two arable Test crops. This changed to **ABe**;
Ln3 (replaced L); three year grass ley with N Treatment crops, followed by two arable Test crops.
Lc3 (replaced Lu); three year grass/clover ley Treatment crops, followed by two arable Test crops.
AM (replaced AF); three years arable Treatment crops, R, BE, M followed by two arable Test crops. This changed to **AO**
ABe (replaced AB); three years arable Treatment crops R, M, BE followed by two arable Test crops.

The Alternating Rotations were changed completely so that the effects of eight year leys on the subsequent arable Test crops could be included.

So that this could be tested every five years (as with the Continuous Rotations) changes to two of the four Alternating Rotations were phased in from 1973 on Block III (and in subsequent years on Blocks V, IV, II and I; **1st cycle**);

and two were phased in from 1978 on Block III (and in subsequent years on Blocks V, IV, II and I; **2nd cycle**).

LLn8 1st cycle (replaced Ar/Lu); eight year grass ley with N Treatment crops, followed by two arable Test crops.

LLc8 1st cycle (replaced Ah/L); eight year grass/clover ley Treatment crops, followed by two arable Test crops.

LLn8 2nd cycle (replaced Lu/Ar); eight year grass ley with N Treatment crops, followed by two arable Test crops.

LLc8 2nd cycle (replaced L/Ah); eight year grass/clover ley Treatment crops, followed by two arable Test crops.

2007 onwards:

AO (replaced AM): three years arable Treatment crops, R, BE, O, followed by two arable Test crops. Oats (O) replaced Maize (M) as a treatment crop
ABe * Oats (O) replaced maize (M) as a treatment crop from 2008 but the same code (ABe) was retained.

The 8-year leys were all stopped from 2007:

LLn/AO (replaced LLn8 1st cycle) into continuous arable with oats in 2007

LLc/ABe (replaced LLc8 1st cycle) into continuous arable with beans in 2007

LLn/Ln3 (replaced LLn8 2nd cycle) into 3-year grass leys with nitrogen from 2008

LLc/Lc3 (replaced LLc8 2nd cycle) into 3-year grass/clover leys from 2008

Block	Treatment ¹ Code (since 1973)	Plots - / D ²	2008			2009		2010			2011		2012			2013 ⁴			2014		2015			2016		2017		2018		2019		2020	
			36	37	38	39	40	41	42	43	44	45	46	47	48																		
III ³	(AF) (AM) AO	40/39	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O			
	(AB) (ABe) ABe	45/46	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE			
	Ln3	43/44	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3			
	Lc3	34/33	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3			
	LLn/AO	36/35	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O			
	LLc/ABe	47/48	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE			
	LLn/Ln3	37/38	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3			
	LLc/Lc3	41/42	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3			
V	(AF) (AM) AO	74/73	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O			
	(AB) (ABe) ABe	68/67	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE			
	Ln3	65/66	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3			
	Lc3	79/80	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3			
	LLn/AO	71/72	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O			
	LLc/ABe	76/75	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE			
	LLn/Ln3	69/70	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3			
	LLc/Lc3	78/77	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3			
IV	(AF) (AM) AO	64/63	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O			
	(AB) (ABe) ABe	53/54	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE			
	Ln3	58/57	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3			
	Lc3	60/59	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3			
	LLn/AO	51/52	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O			
	LLc/ABe	50/49	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE			
	LLn/Ln3	61/62	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3			
	LLc/Lc3	55/56	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3			
II	(AF) (AM) AO	19/20	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O			
	(AB) (ABe) ABe	17/18	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE			
	Ln3	31/32	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3			
	Lc3	29/30	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3			
	LLn/AO	27/28	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O			
	LLc/ABe	22/21	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE			
	LLn/Ln3	26/25	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3			
	LLc/Lc3	23/24	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3			
I	(AF) (AM) AO	6/5	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O			
	(AB) (ABe) ABe	2/1	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE			
	Ln3	14/13	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3			
	Lc3	3/4	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3			
	LLn/AO	9/10	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O	W	R	R	BE	O			
	LLc/ABe	15/16	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE	W	R	R	O	BE			
	LLn/Ln3	12/11	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3			
	LLc/Lc3	7/8	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3	W	R	1	2	3			

Into continuous arable from 2007 (LLn/AO)
 Into continuous arable from 2007 (LLc/ABe)
 Into 3-yr grass leys from 2008 (LLn/Ln)
 Into 3-yr grass/clover leys from 2008 (LLc/Lc)

Into continuous arable from 2007 (LLn/AO)
 Into continuous arable from 2007 (LLc/ABe)
 Into 3-yr grass leys from 2009 (LLn/Ln)
 Into 3-yr grass/clover leys from 2009 (LLc/Lc)

Into continuous arable from 2007 (LLn/AO)
 Into continuous arable from 2007 (LLc/ABe)
 Into 3-yr grass leys from 2010 (LLn/Ln)
 Into 3-yr grass/clover leys from 2010 (LLc/Lc)

Into continuous arable from 2007 (LLn/AO)
 Into continuous arable from 2007 (LLc/ABe)
 Into 3-yr grass leys from 2011 (LLn/Ln)
 Into 3-yr grass/clover leys from 2011 (LLc/Lc)

Into continuous arable from 2007 (LLn/AO)
 Into continuous arable from 2007 (LLc/ABe)
 Into 3-yr grass leys from 2012 (LLn/Ln)
 Into 3-yr grass/clover leys from 2012 (LLc/Lc)

Crops: P=Potatoes; B=Spring barley; W=Winter wheat; K=Kale; H=one-year Hay; SBe=Sugar beet; R=Winter rye; C=Carrots; O=oats; BE=Winter beans; M=Maize; F=Fallow.

L1, L2, L3 = 1st, 2nd, 3rd year of grass-clover ley [given little N, grazed by sheep until 1968 (except for existing 3rd year leys which were grazed in 1969), cut thereafter];
 Lu1, Lu2, Lu3 = 1st, 2nd, 3rd year of Lucerne ley; S1, S2, S3 = 1st, 2nd, 3rd year of Sainfoin (replaced Lucerne from 1964); Lc1, Lc2, Lc3 = 1st, 2nd, 3rd year of Red clover ley (replaced Sainfoin from 1971).
 Ln3, 1, 2, 3 = 1st, 2nd, 3rd year of grass ley given N; Lc3, 1, 2, 3 = 1st, 2nd, 3rd year of grass/clover ley.
 LLn8, 1, 2, 3, 4, 5, 6, 7, 8 = 1st, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th year of grass ley given N; LLc8, 1, 2, 3, 4, 5, 6, 7, 8 = 1st, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th year of grass/clover ley.

² the second of each pair of plots received D (Dung i.e. farmyard manure; 38 t/ha applied for the 1st Test crop i.e. every 5 years) up to and including the 1st Test crop in 1967 (see Table of FYM applications, 10.23637/wrm3-manag1938-2020-01).
³ Block III was the first block to be "phased in", followed by Blocks V, IV, II and I
⁴ All crops (wheat, rye, beans and oats) were spring varieties in 2013 because they were late sown due to very wet autumn and spring weather.
⁵ Winter wheat failed block I 2015, resown to spring wheat