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The Woburn Ley-arable experiment fertilizer and lime applications 1938 - 2020

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Description: Annual fertilizer and lime applications to the Woburn Ley-arable Experiment, 1938-2020

- **Page 1:** Cover page
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- **Pages 11-12:** Lime applications, 1938-2020, to each of the five Blocks
- **Pages 13-15:** Corrective K fertilizer applied to the 1st test crop, 1962-2020, and balancing K applications to the 1st test crop which had not received FYM, 1962-1967, to each of the five Blocks

Site: W/RN/3. Stackyard field, Woburn Experimental Farm, Husborne Crawley, Woburn, Bedfordshire, UK.

Geographic location: [51.99906, -0.61673](https://www.openstreetmap.org/?lat=51.99906&lon=-0.61673)

Supplement to: Johnston et al, 2022. *The Woburn Ley-arable experiment, 1938-2020: its management, the issues and problems that arose, and their resolution to maintain the continuity and relevance of the experiment.*
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- Rothamsted Experimental Station (1966) *Details of the Classical and Long-term experiments up to 1962*. Lawes Agricultural Trust, Harpenden. 87 pp <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
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- Rothamsted Experimental Station (1977) *Details of the Classical and Long-term experiments 1968-73*. Lawes Agricultural Trust, Harpenden. 77 pp <https://doi.org/10.23637/ERADOC-1-193>
- *Annual Yields of the Field Experiments and Results of the Classical and other Long-term experiments* published by Rothamsted Research, 1939-2021 <http://www.era.rothamsted.ac.uk/eradoc/books/2>

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Woburn Ley-arable, W/RN/3

Basal N, P and K fertilizers, amounts and times of application 1938-1948

	Nitrogen (kgN/ha)		Phosphorus (kgP/ha)		Potassium (kgK/ha)	
	as ammonium sulphate ^a		as superphosphate ^b		as potassium sulphate ^c	
Treatment crops	In seedbed / in spring	Top-dressed in spring	In seedbed	Top-dressed in spring	In seedbed	Top-dressed in spring
One-year hay	25		0		0	
Ley 1 st year (1938-1950)	25		27		75	
Ley 2 nd & 3 rd years	0		0		0	
Lucerne 1 st year	0		27		75	
Lucerne 2 nd & 3 rd years	0		0		0	
Potatoes	75		27		75	
W. wheat	25		0		0	
S. barley	25		0		0	
Kale (1938-1944)	75		0		0	
Sugar beet (replaced kale 1945)	75 (1945-46) 100 ^a (1947-48)		0		0	
Test crops						
Potatoes	75		27		75	
S. barley	26		0		0	

^a Nitrogen as ammonium sulphate, (NH₄)₂SO₄ containing 21% N and 24% S. Replaced in sugar beet with sodium nitrate (NaNO₃) in 1947, containing 16% N and 26% Na.

^b Phosphorus as single superphosphate, containing approximately 8% P, 12% S and 20% Ca.

^c Potassium sulphate (K₂SO₄) containing approximately 42% K and 18% S. After 1943 replaced by Muriate of Potash (KCl).

Source: Rothamsted Experimental Station (1970) "Details of the Classical and Long-Term Experiments up to 1967", Rothamsted Experimental Station, Lawes Agricultural Trust, Harpenden UK. DOI: 10.23637/ERADOC-1-192

Woburn Ley-arable, W/RN/3

Basal N, P and K fertilizers, amounts and times of application 1949-1955

Treatment crops	Nitrogen (kgN/ha)		Phosphorus (kgP/ha)		Potassium (kgK/ha)	
	Ammonium sulphate ^a (AS) or Nitro-chalk ^b (NC)		Compound (0:13:13)		Compound (0:13:13)	
	In seedbed / spring	Top-dressed in spring	In seedbed / spring	Top-dressed in spring	In seedbed / spring	Top-dressed in spring
One-year hay before 1 st cut	38 NC		0		0	
One-year hay after 1 st cut ^c		19 NC	0		0	
Ley 1 st year (1949-1950)	25 AS		27		75	
Ley 1 st year (1951-1955)	25 NC		27		75	
Ley 2 nd & 3 rd years	19 NC		0		0	
Lucerne 1 st year	0		27		75	
Lucerne 2 nd & 3 rd years	0		0		0	
Potatoes (1949)	75 AS		27		75	
Potatoes (1950-1955)	75 AS		33		62	
W. wheat	25 AS		0		0	
Rye	56 NC		0		0	
S. barley	29 NC		0		0	
Sugar beet ^d	100		0		0	
Test crops						
Potatoes (1949)	75 AS		27		75	
Potatoes ^e (1950-1955)	70 ^e		31 ^e		87 ^e	
S. barley	29 NC		0		0	

^a Nitrogen as ammonium sulphate, (NH₄)₂SO₄ containing 21% N and 24% S.

^b Nitrogen as 'Nitro-chalk' (calcium ammonium nitrate) containing 15.5%N.

^c One-year hay 1954-1955 plots were split after the first cut to test 19 v 38 kgN/ha as Nitro-chalk.

^d Sugar beet received N as sodium nitrate (NaNO₃), containing 16% N and 26% Na.

^e Potatoes as test crop received NPK as compound (7:7:10.5) from 1950. Plots of the test-crop potatoes were split to test two rates of N and K in 1955.

Source: Rothamsted Experimental Station (1970) "Details of the Classical and Long-Term Experiments up to 1967", Rothamsted Experimental Station, Lawes Agricultural Trust, Harpenden UK. DOI: 10.23637/ERADOC-1-192

Woburn Ley-arable, W/RN/3

Basal N, P and K fertilizers, amounts and times of application 1956-1961

	Nitrogen (kgN/ha)		Phosphorus (kgP/ha)		Potassium (kgK/ha)	
	Ammonium sulphate ^a (AS) or Nitro-chalk ^b (NC)		Compound (0:13:13)		Compound (0:13:13) or muriate of potash (MP)	
Treatment crops	In seedbed / in spring	Top-dressed in spring	In seedbed	Top- dressed in spring	In seedbed	Top- dressed in spring
One-year hay before 1 st cut	60 AS		0			62 MP
One-year hay after 1 st cut		28 NC	0		0	
Ley 1 st year	75 NC		55		104	
Ley 2 nd & 3 rd years	75 NC		0			57 MP
Lucerne 1 st year	0		55		104	
Lucerne 2 nd & 3 rd years	0		0			57 MP
Potatoes ^c	126 ^c		55 ^c		156 ^c	
Rye	75 NC		0		0	
Carrots	60 AS		0		62 MP	
Test crops						
Sugar beet ^d	90 ^d NC		39 ^d		94 ^d	
S. barley	75 NC		0		0	

^a Nitrogen as ammonium sulphate, (NH₄)₂SO₄ containing 21% N and 24% S.

^b Nitrogen as 'Nitro-chalk' (calcium ammonium nitrate) containing 15.5%N.

^c Potatoes fertilizer applied as compound (7:7:10.5)

^d Sugar beet test crops tested 0 v 90 kgN/ha and 0 v 94 kgK/ha on sub-plots. Basal N, P and K applied as compound (12:12:15).

Source: Rothamsted Experimental Station (1970) "Details of the Classical and Long-Term Experiments up to 1967", Rothamsted Experimental Station, Lawes Agricultural Trust, Harpenden UK. DOI: 10.23637/ERADOC-1-192

Woburn Ley-arable, W/RN/3

Basal N, P, and K fertilizers, amounts and times of application 1962-1967

	Nitrogen (kgN/ha)		Phosphorus (kgP/ha)		Potassium (kgK/ha)	
	Nitro-chalk	Compound (16:0:16)	Superphosphate	Compound (0:14:28)	Muriate of potash	Compound (16:0:16) or (0:14:28)
Treatment crops	In seedbed / in spring	Top-dressed in spring	In seedbed / in spring	Top-dressed in spring	In seedbed / in spring	Top-dressed in spring
One-year hay ^a	126 ^a	75 ^a	33	0	125	62 ^a
Ley 1 st year ^b	50 ^b	100 ^b	82	0	104 MP	83 ^b
Ley 2 nd & 3 rd years		151 ^c		0		125 ^c
Lucerne/sainfoin 1 st year ^d	63 ^d		82		104 MP	
Lucerne/sainfoin 2 nd & 3 rd years ^e	63 ^e		27 ^f		156 ^g	
Potatoes	126		49		187 MP	
Rye ^h	75		16 ⁱ		62 ⁱ	
Carrots	75		33		187 MP	
Test crops						
Sugar beet ^j 1965-67	Test N rates		109 ^j		Test K rates	
S. barley	75		16		0	

^a One-year hay in 1962 received 75 kgN before 1st cut and 28 kgN after 1st cut as Nitro-chalk (calcium ammonium nitrate). K applied as muriate of potash (KCl) in 1962 after 1st cut. Top dressed in spring after 1st cut.

^b Ley 1st year. Received 0 and 38kgN/ha in seedbed 1962 and 1963 respectively. Received 75 kgN/ha top-dressed in spring, 1962 and 1963. Received 0 and 62 kgK/ha top dressed in spring 1962 and 1963 respectively

^c Ley 2nd & 3rd years 69 and 113 kgN/ha and 57 and 94 kgK/ha in 1962 and 1963 respectively.

^d Lucerne replaced by Sainfoin from 1964. No N applied to Lucerne in 1962.

^e 2nd and 3rd lucerne in 1962 received no N. Lucerne replaced by Sainfoin from 1965. Sainfoin failed in 2nd year 1965 and resown, no N applied. 3rd year Sainfoin failed in 1966 and resown, no N applied.

^f P applied where Sainfoin failed and resown in 1965 (2nd and 3rd year Sainfoin), and 1966 (3rd year Sainfoin) as superphosphate (in 1965 3rd year) or compound (0:20:20)

^g K applied at 52 kgK/ha as compound (0:20:20) where Sainfoin failed and was resown in 1965 (2nd year Sainfoin), and 1966 (3rd year Sainfoin)

^h Rye failed in 1967 and was replaced with spring wheat, no P or K applied.

ⁱ Rye P and K applied as compound (0:14:28).

^j Sugar beet test crop tested rates of N, 1962-1967, rates of P 1962-1964, rates of K 1962-1967 and rates of Mg 1962-1963.

Source: Rothamsted Experimental Station (1970) "Details of the Classical and Long-Term Experiments up to 1967", Rothamsted Experimental Station, Lawes Agricultural Trust, Harpenden UK. DOI: 10.23637/ERADOC-1-192

Yield books for 1962-1967.

Woburn Ley-arable, W/RN/3
Basal N, P, and K fertilizers, amounts and times of application
1968-1975

	Nitrogen (kgN/ha)		Phosphorus (kgP/ha)		Potassium (kgK/ha)	
	Nitro-chalk ^a (NC)	Compound (25:0:16)	Superphosphate ^b (SP) Compound (0:14:28)		Muriate of potash ^c (MOP) Compound (0:14:28) or (25:0:16)	
Treatment crops	In seedbed / in spring	Top-dressed in spring	In seedbed / in spring	Top-dressed in spring	In seedbed / in spring	Top- dressed in spring
One-year hay ^d	125 NC	75 ^d	33	0	125	42 ^d
Ley 1 st year ^e	50 NC	100 ^e	82 SP	0	104 MOP	52 ^e
Ley 2 nd & 3 rd years ^f		150 ^f		0		77 ^f
Sainfoin 1 st year 1968-71	63 NC		82 SP		105 MOP	
Clover 1 st year 1972-75 ^g	63 NC		82 SP		105 MOP	
Sainfoin 2 nd & 3 rd years 1968-71	63 NC		0		156 MOP	
Clover 2 nd and 3 rd years 1972-75 ^g	63 NC		0		156 MOP	
Potatoes ^h	250 ^h		110 ^h		320 ^h	
Rye 1968-71 ⁱ	40 ^f NC		17		62	
S Barley 1972-75 ^j	63		27		52	
Carrots 1968-71	75 NC		33 SP		187 MOP	
Test crops						
S barley 1 st test crop 1968-1970	Test N rates		27		52	
Potatoes 1 st test crop 1971-75	250 ^h		110 ^h		320 ^h	
S barley ^k 2 nd test crop 1968-1971	63 ^k		27		52 ^k	
Wheat 1972-75	Test N rates		26		50	

^a Nitrogen as 'Nitro-chalk' (calcium ammonium nitrate) containing 15.5%N.

^b Phosphorus as single superphosphate, containing approximately 8% P, 12% S and 20% Ca.

^c K as muriate of potash (KCl).

^d One-year hay top-dressed after 1st cut 1968, N and K applied as compound (16:0:16), 75kgN and 62 kgK.

^e 1st year ley 75 kgN and 62kgK in 1968 as (16:0:16); 50kgN and 27 kgK in 1971 as (25:0:16).

^f 2nd and 3rd year ley, 100kgN 1968 and 1969 (2nd year cut); 90 kgN 1974-75. 83 and 52 kgK/ha 1968 and 1969 (2nd year cut); 48 kgK 1974-75.

^g Sainfoin replaced by clover from 1972.

^h Potatoes 1968-70 received no N, 50 kgP and 187 kgK (0:14:28). 1971-1975 NPK applied as compound (13:13:20).

ⁱ Rye replaced by spring barley in 1972. Rye received 75 kgN in 1968. P and K applied as compound (0:14:28).

^j Barley received NPK as compound (15:15:15)

^k Spring barley 2nd test crop 75kgN/ha and no K in 1968.

Magnesium sulphate (Epsom salts) was applied to first treatment crops in the seed bed in 1968-1969 as 62kg Mg/ha and 37 kg Mg/ha in 1970.

These are the basal fertilizer treatments planned for each year, there were some minor differences from year to year.

Source: Rothamsted (1977) "Details of the Classical and Long-Term Experiments 1968-1973", Rothamsted Experimental Station, Lawes Agricultural Trust, Harpenden UK, (77pp) DOI: 10.23637/ERADOC-1-193

Yield books for 1974-1975.

Woburn Ley-arable, W/RN/3
Basal N, P, and K fertilizers, amounts and times of application
Major revisions were made to the experiment in 1976.

1976-1999
kg per hectare

	Nitrogen (N)		Phosphorus (P)		Potassium (K)	
	Nitro-chalk ^a (NC) or compound		Compound		Compound or muriate of potash (MOP)	
Treatment crops	Seedbed or winter	Spring and after each cut except last	Seedbed or winter	After each cut except the last	Seedbed or winter	Spring and after each cut except last
1 st year all-grass ley ^b	75 NC	75	33	0	125	40
1 st year grass/clover ley ^c	0	0	33	0	125	40 MOP
2 nd + year all-grass ley ^b	0	75	33	0	125	40
2 nd + year grass/clover ley ^c	0	0	33	0	125	40 MOP
S. Barley ^d 1976-1998	80	(60 ^e) NC	17	-	33	-
W. Oats ^f 1976-1980	80	-	24	-	46	-
Fallow 1976-	0	-	0	-	0	-
Beans ^g 1981-	0	-	17	-	33	-
Potatoes ^h 1983	199	-	87	-	248	-
W rye ⁱ 1998-	20 NC	80	27	17	52	33
Forage maize 1999	100 NC	-	17	-	33	20 MOP
Test crops^j						
W. wheat 1 st test crop	Test N rates	-	27	-	52	-
W. wheat 2 nd test crop	Test N rates	-	26	-	50	-
S barley 2 nd test crop	Test N rates	-	26	-	50	-
W. rye 2 nd test crop	Test N rates	-	27	-	52	

^a Nitrogen as Nitro-chalk (calcium ammonium nitrate) containing 15.5%N.

^b N applied as Nitro-chalk in seedbed and compound (25:0:16) in spring. P and K applied as various compounds (e.g. 0:14:28) in the seedbed and K as compound (25:0:16) in spring. 41kgP applied in seedbed from 1995 onwards.

^c P and K applied as various compounds (eg 0:14:28) in the seedbed and K as muriate of potash (KCl) in spring. 41kgP applied in seedbed from 1995 onwards. No N applied to grass/clover leys, except 50kgN in seedbed 1986-1989, 1998, 1999.

^d NPK applied as compound (25:14:14), 1976-1980, with 24kgP and 46 kgK. From 1981 applied as (20:10:10) with 17kgP and 33 kg K.

^e Top-dressed N applied to s barley in 1983 due to much leaching in the wet spring and subsequent poor growth.

^f W oats N, P and K applied as compound (25:14:14).

^g Beans P and K applied as compound (0:20:20), 1981-1984 then (0:24:24) from 1985 onwards. Spring beans 1981-1985, winter beans 1986 onwards.

^h Treatment crop of beans failed in 1983 and was replaced by potatoes. NPK applied as compound (10:10:15) plus 90 kgMg.

ⁱ Winter rye received PK as compound (0:24:24) in seedbed and NPK as compound (20:10:10) in spring. 80 kgN, 17kg P and 33 kgK in seedbed 1999.

^j Test crops: Winter wheat 1st test, 1976-, 2nd test crop 1976. Spring barley 2nd test crop 1977-1991. Winter rye 2nd test crop from 1992. Basal P and K applied as compound (0:20:20) until 1984 then as (0:24:24).

These are the basal fertilizer treatments planned for each year, there were some minor differences from year to year.

Woburn Ley-arable experiment, W/RN/3

Basal N, P, K and S fertilizers, amounts and times of application kg per hectare

2000-2007

	Nitrogen (N)		Phosphorus (P)		Potassium (K)			Sulphur (S)
	Calcium ammonium nitrate 27%N		Triple superphosphate (TSP)		Potassium sulphate ^a or muriate of potash ^b (MOP)			Potassium sulphate ^a
Treatment crops	Seedbed	Early spring and after each cut except the last	Early autumn	Late autumn	Autumn	Early Spring	After each cut except the last	Autumn
1 st year all-grass ley ^c	50	-	43.6	-	58.1	83 MOP	41.5 MOP	25.2
1 st year grass/clover ley ^c	25	-	43.6	-	58.1	83 MOP	41.5 MOP	25.2
2 nd + year all-grass ley ^d	-	75	-	43.6	58.1	83 MOP	41.5 MOP	25.2
2 nd + year grass/clover ley ^d	-	-	-	43.6	58.1	83 MOP	41.5 MOP	25.2
	Seedbed	Spring				Early spring		Early spring
W. beans ^e	-	-	26.2	-	-	58.1	-	25.2
W. rye ^e	-	80	26.2	-	-	58.1	-	25.2
Forage maize ^e	100	-	26.2	-	-	58.1	-	25.2
Test crops ^f								
W. wheat ^g	Test N	-	26.2	-	-	58.1	-	25.2
W. rye ^h	Test N	-	26.2	-	-	58.1	-	25.2

^a Potassium sulphate (K₂SO₄) which supplies both K and S.

^b Muriate of potash (KCl) shown as MOP

^c TSP and K₂SO₄ applied to stubble of preceding w.rye (2nd test crop).

^d TSP and K₂SO₄ applied after final cuts in preceding year (1 – 7-year leys).

^e TSP applied to stubble of preceding crops. K₂SO₄ applied in early spring. N applied once in spring to w.rye and to seedbed in late spring (April-May) to maize. No N applied to beans.

^f W. wheat (1st test crop) and w. rye (2nd test crop) receive test N as per plans.

^g TSP applied to stubble of preceding arable treatment crops or the preceding years 3 year or 8-year leys where the 2nd cut has (usually) been taken early and the sward then killed with glyphosate. K₂SO₄ applied in early spring.

^h TSP applied to stubble of preceding w. wheat (1st test crop). K₂SO₄ applied in early spring.

These are the basal fertilizer treatments planned for each year, there were some minor differences from year to year.

Woburn Ley-arable experiment, W/RN/3

Basal N, P, K and S fertilizers, amounts and times of application kg per hectare

2008- 2020

	Nitrogen (N)		Phosphorus (P)		Potassium (K)			Sulphur (S)
	Calcium ammonium nitrate 27%N		Triple superphosphate (TSP)		Potassium sulphate ^a or muriate of potash ^b (MOP)			Potassium sulphate ^a
Treatment crops	Seedbed	Early spring and after each cut except the last	Early autumn	Late autumn	Autumn	Early Spring	After each cut except the last	Autumn
1 st year all-grass ley ^c	50	-	43.6	-	58.1	83 MOP	41.5 MOP	25.2
1 st year grass/clover ley ^c	25	-	43.6	-	58.1	83 MOP	41.5 MOP	25.2
2 nd + year all-grass ley ^d	-	75	-	43.6	58.1	83 MOP	41.5 MOP	25.2
2 nd + year grass/clover ley ^d	-	-	-	43.6	58.1	83 MOP	41.5 MOP	25.2
	Seedbed	Spring				Early spring		Early spring
W. beans ^e	-	-	26.2	-	-	62.25	-	27
W. rye ^e	-	100	26.2	-	-	62.25	-	27
Forage maize ^e	100	-	26.2	-	-	62.25	-	27
W. oats ^e		100	26.2			62.25	-	27
Test crops^f								
W. wheat ^g	Test N	-	26.2	-	-	62.25	-	27
W. rye ^h	Test N	-	26.2	-	-	62.25	-	27

^a Potassium sulphate (K₂SO₄) which supplies both K and S; not applied in 2010, except to 1st year leys.

^b Muriate of potash (KCl) shown as MOP

^c TSP and K₂SO₄ applied to stubble of preceding w.rye (2nd test crop).

^d TSP and K₂SO₄ applied after final cuts in preceding year (1 – 7-year leys).

^e TSP applied to stubble of preceding crops. K₂SO₄ applied in early spring. N applied once in spring to w.rye and w oats and to seedbed in late spring (April-May) to maize. No N applied to beans.

^f W. wheat (1st test crop) and w. rye (2nd test crop) receive test N as per plans.

^g TSP applied to stubble of preceding arable treatment crops or the preceding years 3 year or 8-year leys where the 2nd cut has (usually) been taken early and the sward then killed with glyphosate. K₂SO₄ applied in early spring.

^h TSP applied to stubble of preceding w. wheat (1st test crop). K₂SO₄ applied in early spring.

These are the basal fertilizer treatments planned for each year, there were some minor differences from year to year.

Woburn Ley-arable experiment, W/RN/3/ 1964 - 2020

Summary of tests of different rates of fertilizer N applied to the arable test crops.

The test crops were divided into four sub-plots to test four rates of fertilizer N, 1972 onwards, designated N0, N1, N2 and N3. There were also tests of four N rates on the spring barley grown as the 1st test crop, 1968-1970, with different rates depending on the rotation, and other tests of different N rates on sugar beet grown as the 1st test crop, 1964-1967.

Sugar beet, 1st test crop, 1964-1967, kgN/ha

Code	1964 Rotations L and S	1964 Rotations AR and AH	1965-1967 all rotations
N44			44
N88			88
N132	132		132
N176	176	176	176
N220		220	220
N264			264

Spring barley, 1st test crop 1968-1970, 2nd test crop 1977-1991, kgN/ha:

Code	1 st test crop 1968-1970 Rotations L and S Rotations AR and AH		2 nd test crop 1977-1981	2 nd test crop 1982-1991*
N0	0		0	0
N1	50	50	50	60
N2	100	100	100	120
N3	150	150	150	180
N4		200		

*in 1983 following very heavy rainfall after application, a further 60kgN/ha was applied to all sub-plots except N0

Winter wheat 1st test crop (and 2nd test crop, 1972-1976) kgN/ha

Code	2 nd crop 1972-1976; 1 st crop 1976-1981;	1 st test crop 1982-2006	1 st test crop 2007-2020
N0	0	0	0
N1	63	70	80 (40+40)
N2	126	140	160 (40+120)
N3	189	210	240 (40+200)

Rye 2nd test crop, kgN/ha:

Code	1992-1996	1997-2006	2007-2020
N0	0	0	0
N1	30	40	50
N2	60	80	100
N3	90	120	150

Sources: Rothamsted Experimental Station (1977) "Details of the Classical and Long-Term Experiments 1968-1973", *Rothamsted Experimental Station, Lawes Agricultural Trust, Harpenden UK*, (77pp). DOI: [10.23637/ERADOC-1-193](https://doi.org/10.23637/ERADOC-1-193)

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), DOI: [10.23637/ERADOC-1-192](https://doi.org/10.23637/ERADOC-1-192)

Yield books for various years, <http://www.era.rothamsted.ac.uk/eradoc/books/2>

Woburn Ley-arable experiment.							
Liming with calcium carbonate or magnesian limestone, 1938-2021							
Occasional dressings of chalk were applied before the experiment started.							
Applied before the second test crop							
	Block/Amount (t/ha)						
						Harvest	
Date applied	III	V	IV	II	I	year	Form
1938-46	No chalk applied						
late-1946/early-1947	1.88					1947	Calcium carbonate
04/03/1948		1.88				1948	Calcium carbonate
17/02/1949			1.88			1949	Calcium carbonate
27/02/1950				1.88		1950	Calcium carbonate
05/04/1951					1.88	1951	Calcium carbonate
29/02/1952	1.88					1952	Calcium carbonate
25/02/1953		2.38				1953	Calcium carbonate
08/03/1954			2.38			1954	Calcium carbonate
14/03/1955				2.38		1955	Calcium carbonate
08/12/1955					2.38	1956	Calcium carbonate
27/02/1957	2.38					1957	Calcium carbonate
05/03/1958		2.89		1.51 (Ar and Ah)		1958	Calcium carbonate
24/12/1958			2.26			1959	Calcium carbonate
27/11/1959	2.51 (Ar and Ah)			2.26		1960	Calcium carbonate.
05/01/1961					5.02	1961	Calcium carbonate
03/11/1961	5.02					1962	Calcium carbonate
27/10/1962		5.02				1963	Calcium carbonate
23/12/1963			5.02			1964	Calcium carbonate
13/11/1964				5.02		1965	Calcium carbonate
14/12/1965	4.39				4.39	1966	Calcium carbonate
04/11/1966	5.02					1967	Calcium carbonate
17/11/1967		5.65				1968	Magnesian limestone
04/11/1968			5.02			1969	Magnesian limestone
02/10/1969				5.02		1970	Calcium carbonate
08/10/1970					5.02	1971	Magnesian limestone
06/10/1971	5					1972	Magnesian limestone
07/10/1972		5				1973	Magnesian limestone
11/10/1973			5			1974	Magnesian limestone
07/11/1974				5		1975	Magnesian limestone
13/10/1975					5	1976	Magnesian limestone
Liming applications in new cropping sequence							
06/09/1976	5					1977	Magnesian limestone
21/10/1977		5				1978	Magnesian limestone
09/10/1978			5			1979	Magnesian limestone
31/10/1979				5		1980	Magnesian limestone
24/10/1980					5	1981	Magnesian limestone

Date applied	III	V	IV	II	I	Harvest	Form	
						year		
01/10/1981	5					1982	Magnesian limestone	
05/10/1982		5				1983	Magnesian limestone	
30/09/1983			5			1984	Magnesian limestone	
23/10/1984				7.5		1985	Magnesian limestone	
29/11/1985					7.5	1986	Magnesian limestone	
28/11/1986	5					1987	Magnesian limestone	
-		(-)				1988	None applied	
29/11/1988		5	5			1989	Magnesian limestone	
16/02/1990				5		1990	Calcium carbonate	
19/08/1990					5	1991	Magnesian limestone	
11/10/1991	5					1992	Magnesian limestone	
06/10/1992		5				1993	Magnesian limestone	
21/10/1993			5			1994	Magnesian limestone	
04/10/1994				5		1995	Magnesian limestone	
05/10/1995					5	1996	Magnesian limestone	
-	(-)					1997	None applied	
-		(-)				1998	None applied	
-			(-)			1999	None applied	
-				(-)		2000	None applied	
-					(-)	2001	None applied	
-	(-)					2002	None applied	
26/09/2002	5	5				2003	Calcium carbonate	
03/10/2003			5			2004	Calcium carbonate	
16/09/2004				5		2005	Calcium carbonate	
08/10/2005					5	2006	Calcium carbonate (not to ABe & AM plots)	
11/10/2006	5					2007	Calcium carbonate	
06/10/2007		5				2008	Calcium carbonate	
16/10/2008			5			2009	Calcium carbonate	
12/10/2009				5		2010	Calcium carbonate	
30/09/2010					5	2011	Calcium carbonate	
21/10/2011	5					2012	Calcium carbonate	
16/11/2012		5				2013	Calcium carbonate	
18/10/2013			5			2014	Calcium carbonate	
21/10/2014				5		2015	Calcium carbonate	
10/11/2015					5	2016	Calcium carbonate	
20/09/2016	5					2017	Calcium carbonate	
20/10/2017		5				2018	Calcium carbonate	
14/09/2018			5			2019	Calcium carbonate	
07/10/2019				5		2020	Calcium carbonate	
10/11/2020					5	2021	Calcium carbonate	
(-) Not applied								
Note:								
Magnesian limestone (Dolomite) was applied for many years to increase levels of Exchangeable Mg								

Corrective fertilizer K applications ^a for the 1st Test crop and Balancing dressings ^b added for the 1st Test crop i.e. amount of fertilizer K added to plots that had NOT had FYM applied to the 1st Test crop (nominally equivalent to the measured amount of K in the FYM). Woburn Ley-arable experiment, 1962-2020.																	
				Corrective	Balancing ^b	Corrective	Balancing ^b	Corrective	Corrective	Corrective	Corrective	Corrective	Corrective	Corrective	Corrective	Corrective	Corrective
			Without	K ₂ O	K ₂ O	K ₂ O	K ₂ O	K ₂ O	K ₂ O	K ₂ O	K ₂ O	K ₂ O	K ₂ O	K ₂ O	K ₂ O	K ₂ O	K ₂ O
			or with d	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha
	Rotation	Plot no.	(FYM) ^c	1961	1961	1966	1966	1971	1976	1981	1986	1991	1996	2001	2006	2011	2016
Block III	Lu	33	d			628		126	126	113	113	0	0	0	0	0	0
		34				628	602	126	0	113	264	0	0	0	0	0	0
	Ar/Lu	35	d			502		314	226	251	364	0	0	0	0	120	230
		36				628	602	188	213	251	238	0	0	0	0	30	130
	Lu/Ar	37				753	602	188	188	188	276	100	0	0	0	0	20
		38	d			628		439	163	138	264	35	0	0	0	0	50
	Ar	39	d			628		0	289	251	577	180	300	260	190	350	350
		40				628	602	0	264	188	552	295	300	260	190	300	370
	L/Ah	41				628	602	126	201	126	0	0	0	0	0	0	0
		42	d			628		126	151	25	63	0	0	0	0	0	0
	L	43				251	602	126	238	126	264	0	0	0	0	0	50
		44	d			0		126	176	52	264	0	0	0	0	0	0
	Ah	45				753	602	188	0	276	577	180	300	280	230	250	310
		46	d			753		188	75	301	502	180	300	260	330	270	380
	Ah/L	47				502	602	63	213	13	221	0	0	0	0	0	120
		48	d			0		63	238	0	314	0	0	0	0	0	150
				1962	1962	1967	1967	1972	1977	1982	1987	1992	1997	2002	2007	2012	2017
Block V	L	65		163	376	251	238	251	50	163	339	0	0	60	0	70	0
		66	d	0		126		251	0	151	276	75	0	20	0	90	0
	Ah	67	d	402		502		251	113	251	527	230	300	210	260	270	100
		68		452	376	628	238	314	113	276	452	260	300	180	350	340	10
	Lu/Ar	69		452	376	377	238	439	113	126	163	75	0	0	0	0	0
		70	d	402		377		376	126	98	213	30	0	0	0	0	0
	Ae/Lu	71		452	376	502	238	376	126	233	301	45	0	0	0	0	20
		72	d	402		502		376	126	188	351	40	0	0	0	30	20
	Ar	73	d	402		251		314	151	276	552	235	300	190	220	270	110
		74		452	376	251	238	314	188	263	540	260	300	190	210	200	60
	Ah/L	75	d	402		251		251	0	25	100	0	0	0	0	0	0
		76		452	376	377	238	251	100	15	0	0	0	0	0	0	0
	L/Ah	77	d	289		0		126	0	151	213	0	0	0	0	0	0
		78		364	376	251	238	126	63	88	100	0	0	0	0	0	0
	Lu	79		452	376	502	238	0	80	0	126	0	0	0	0	0	0
		80	d	402		377		0	100	38	75	0	0	0	0	0	0

				1963	1963	1968		1973	1978	1983	1988	1993	1998	2003	2008	2013 ^h	2018
Block IV	LLc8	49	d	753		63		439	38	0	40	0	0	0	0	0	150
		50		753	402	0		439	100	0	95	0	0	0	0	0	150
	LLn8	51		753	402	628		439	264	226	0	0	0	0	0	0	200
		52	d	753		377		502	264	251	0	0	0	0	0	0	100
	AB	53		753	402	628		314	126	264	265	375 ^f	240	250	190	140	150
		54	d	753		502		376	138	264	275	245	230	250	220	180	170
	LLc8	55		377	402	628		251	75	251	0	0	0	0	0	0	0
		56	d	377	402 ^d	377		0	0	0	0	0	0	0	0	0	0
	Ln3	57	d	0		126		502	176	276	0	0	0	0	0	0	0
		58		377	402	0		502	326	276	0	0	0	0	0	0	0
	Lc3	59	d	753		377		126	126	163	0	0	0	0	0	0	0
		60		753	402	377		126	63	188	0	0	0	0	0	0	0
	Lln8	61		753	402	628		502	151	301	0	0	0	0	0	0	0
		62	d	753		377		502	213	163	0	0	0	0	0	0	0
	AF / AM /	63	d	753		251		439	163	251	120	260	270	250	210	200	240
		64		753	402	251		439	126	289	155	240	240	250	220	160	100
				1964	1964	1969		1974	1979	1984	1989	1994	1999	2004	2009	2014 ^j	2019
Block II	Ah	17		502	464	502		38	188	653	335	325	300	460	370	430	330
		18	d	377		439		100	201	753	280	290	300	520	400	430	310
	Ar	19		377	464	377		151	238	665	185	315	300	310	290	350	300
		20	d	377		377		0	188	640	115	280	300	270	210	260	300
	Ah/L	21	d	251		251		251	0	0	0	0	0	0	0	310	160
		22		377	464	377		251	0	75	0	0	0	60	0	270	220
	L/Ah	23		377	464	377		176	138	289	0	0	0	0	0	0	0
		24	d	377		377		188	0	377	0	0	0	0	0	0	0
	Lu/Ar	25	d	251		502		389	100	289	0	0	0	0	0	0	0
		26		377	464	502		238	226	343	0	0	0	20	0	0	0
	Ar/Lu	27		377	464	251		231	138	489	70	0	0	0	0	220	210
		28	d	251		251		50	213	326	0	0	0	0	0	180	180
	Lu	29		377	464	439		88	63	301	0	0	0	0	0	10	0
		30	d	377		314		38	0	364	0	0	0	0	0	10	0
	L	31		377	464	188		201	289	452	115	0	0	50	0	0	0
		32	d	0		0		276	251	527	85	0	0	60	0	0	0
				1965	1965	1970		1975	1980	1985	1990	1995	2000 ^e	2005	2010	2015	2020
Block I	Ah	1	d	377		628		0	276	740	155	420 ^g	360	420	380	500	260
		2		502	414	628		63	251	678	155	420 ^g	245	360	400	420	280
	Lu	3		377	414	439		201	0	151	0	0	0	0	0	0	0
		4	d	377		377		264	0	176	0	0	0	0	0	0	0
	Ar	5	d	251		251		138	289	628	220	420 ^g	245	460	360	480	380
		6		377	414	377		75	326	653	200	420 ^g	265	350	340	390	260
	L/Ah	7		377	414	502		213	113	176	0	0	0	0	0	0	0

		8	d	126		502		238	13	138	0	0	0	0	0	0	0
	Ar/Lu	9		377	414	251		63	50	188	60	0	0	0	140	310	310
		10	d	377		63		163	63	213	120	0	0	0	90	290	240
	Lu/Ar	11	d	377		439		188	75	289	0	0	0	0	0	0	60
		12		377	414	439		151	38	301	0	0	0	0	0	0	0
	L	13	d	0		0		56	113	364	145	0	0	0	0	0	110
		14		0	414	200		176	138	326	125	0	0	0	0	0	130
	Ah/L	15		377	414	439		151	75	264	20	0	0	0	0	190	200
		16	d	251		314		138	0	0	0	0	0	0	0	150	90
^a Corrective K applications.																	
Starting in autumn 1961 soil samples (0-25cm) were taken from the block intended to be in the 1st Test crop the following year i.e. Block V in 1962.																	
Soils were analysed for Exchangeable K, initially by swirling with 0.3 N HCl (converted to Exchangeable K by a factor of 1.2), then, from 1964 by swirling with N NH ₄ Ac,																	
then from 1977, by leaching with N NH ₄ Ac. Initially, Corrective K applications were calculated by raising Exchangeable K in each plot to that of the highest in the block.																	
A soil weight of 3.36 M kg soil/ha was used to calculate the amount of K required. The amount of K ₂ O needed was then calculated on the basis of 83.01 %K in K ₂ O and a																	
figure for the "rounded" amount of K ₂ O was given the Farm for application; figures up to 1987 do not appear to be rounded as they were originally calculated in cwt/acre																	
(which was rounded to the nearest 0.1 cwt/acre). No allowance was made for the amount of applied K that might go into non-exchangeable forms.																	
From harvest year 1988, it was decided that, rather than raising the concentration of K in each plot to that of the highest value the concentration should instead be raised to																	
250 mg/kg Exchangeable K (K Index 2 in RB209; a value above which no response to added K would be expected). This resulted in far fewer plots requiring Corrective K.																	
However, it is worth noting that basal fertilizer rates including K had increased over the years (see Basal Fertilizer application tables).																	
Until autumn 1990 (harvest year 1991) soils were usually sampled in September prior to plots (other than those part way through a long ley) being ploughed for the 1st Test																	
crop. However, in many years it was difficult to sample the plots, particularly the leys, in good time especially if it was a dry season and then get the soil analysed for Exchangeable K.																	
It was therefore decided that, starting in 1991 (for the 1st Test of winter wheat in 1992) the soils would be sampled in early spring before basal P and K was applied to																	
enable the K analysis to be completed in good time. Corrective K applications, ploughing and drilling could therefore be more timely in the autumn. Although one seasons																	
offtake would be "missed" the Corrective K should be enough to maintain exchangeable K at an adequate level.																	
^b A balancing dressing of K ₂ O equivalent to the measured amount in the FYM was applied from 1962-1967 to those plots which didn't receive FYM.																	
^c d = 38 t/ha FYM (every five years to 1st test crop until 1967). FYM (farmyard manure) was made from pigs until 1966, from bullocks in 1967. See separate table for amount added in FYM.																	
^d BlockIV, 1963, plots 56 and 58: FYM equivalent K. The FYM equivalent K for plot 58 which receives no FYM, was applied in error to FYM plot 56.																	
With the spring application of corrective K, this error was rectified on plot 58 but no correction is made to plot 56.																	
^e In 2000 the corrective K dressing was omitted in error, and applied in spring 2001 to the rye crop.																	
Corrections (there are some small rounding differences between the values given to the farm, which appear in the Yield Books and calculations. These have been ignored)																	
^f 1993 plot 53 error in Yield book, shown as 275 instead of 375.																	
^g 1995. All rounded to 420 from original calculations																	
^h 2013. Yield book shows 2012 application in error. This table shows correct applications made.																	
^j 2014. Yield book omits applications made to plots 21 and 22 in error. This table shows correct applications made.																	