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Rothamsted Long-term Experiments Farm Diary and Yields of the Classical and Other Long-term Experiments Weather Summaries 2023



[Full Table of Content](#)

2023/W/RN/12 - Woburn Organic Manuring (Stackyard B, Woburn Farm)

Rothamsted Research

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2023/W/RN/12 WOBURN ORGANIC MANURING (Stackyard B, Woburn)

Object: To study, from crop yields and soil analyses, the effects of a range of types of organic matter – Woburn, Stackyard B. The 59th year, winter rye. For previous years see 'Details' 1973 and Yield Books for 1974-2022/W/RN/12.

Design: 4 blocks of 8 main plots, with main plots divided into 6 sub-plots for differential N application

Whole plot dimensions: 8.0 m × 29.5 m (8.0 m × 26.5 m on Block III).

Treatments: From 1966 to 1971 the experiment had a preliminary period designed to build up organic matter from different sources. An arable rotation was started on two blocks in 1972 and the remaining two blocks in 1973. After a period of testing the residues, a further period of accumulation was started; on two blocks (which included ley sown in 1979) in 1981 and on the other two (which included ley sown in 1980) in 1982. A second test phase began when leys on the first pair of blocks were ploughed for the 1st test crop in 1987 and on the second pair for the 1st test crop in 1988. From 1988 two blocks, and 1989 the other two, to 1994, plots were split into 6 sub-plots to test 6 levels of N (including a 0). From 1995 to 1997 residual effects of that N were measured. In 1998 to 2000 yields were taken from whole plots only. In 2001 plots were split into half-plots to test two rates of N. For 2003 the experiment was modified to test further inputs of organic matter in a third phase. An arable rotation (winter rye, spring barley, winter beans, winter wheat, forage maize) was started on seven plots within each block; the eighth was sown to a grass/clover ley. A modification was made to two of the treatments for the 2023 crop onwards.

Whole plots

Previous and current treatments (not necessarily applied each year)

Treatments 1966-1971/1972	Treatments 1979/1982-1986/1987	Treatments since 2003	Treatments since 2023
(Fd)	(Fd)	F	
(Ln)	(Lc6)	(F)	AD
(St)	(St)	St	
(Gm)	(Lc8)	CC	
(Pt)	(Lc8)	Co	
(Fs)	(Fs)	Dg10	
(Dg)	(Dg)	(Dg25)	F
(Lc)	(Lc6)	Lc	

Current treatment codes (application rates of organics are on a fresh weight basis):

Previous	Current	Current treatment
(Fd)	F	No organic amendment
(Dg) (Dg25)	F	No organic amendment
(Fs)	Dg10	FYM @ 10 t/ha annually
(St)	St	Chopped wheat straw @ 7.5 t/ha annually
(Gm) (Lc8)	CC	Cover crop (white mustard @ 10 kg/ha) prior to spring-sown crop
(Pt) (Lc8)	Co	Compost @ 40 t/ha annually
(Ln) (Lc6) (F)	AD	Anaerobic digestate @ 30 t/ha annually (from 2023)
(Lc) (Lc6)	Lc	Permanent grass/clover: Timothy, Fescue & white clover sown @ 30 kg/ha; 04/10/2002

Notes

- Since 2003, all treatments receive PKS fertilizers (see below).
- N applied as calcium ammonium nitrate (Nitro-chalk; 27 % N) to all crops **EXCEPT w. beans**, and to all treatments **EXCEPT Lc**, at 6 rates which cycle (see below).
- CC is only a treatment in years with a spring crop (**spring barley** or **forage maize**); all other plots in those years are bare fallow over winter.

Previous treatment codes (application rates of organics are on a fresh weight basis):

(Dg)	FYM at 50 t/ha annually 1965-1971, and 1981-1985; became (Dg25)
(St)	Straw annually 1965-1971, and 1981-1985; remains as St
(Gm)	Green manure annually 1965-1971; became (Lc8)
(Pt)	Peat annually 1965-71; became (Lc8)
(Lc)	Grass /clover ley 1965-1971; became (Lc6)
(Ln)	Grass ley with N 1965-1971; became (Lc6)
(Fd)	PKMg equivalent to (Dg) rate, annually 1965-1971, and 1981-1986 (blocks 1 & 3), 1981-1987 (blocks 2 & 4); became F
(Fs)	KMg equivalent to (St) with P, annually 1965-1971, then half (Fd) rate 1981-1986 (blocks 1 & 3), 1981-1987 (blocks 2 & 4); became Dg10
(Lc8)	(replaced (Gm) and (Pt)) Grass/clover ley (8-year) 1979-1986 (blocks 1 & 3), 1980/1981-1987 (blocks 2 & 4); became CC (former (Gm)) or Co (former (Pt))
(Lc6)	(replaced (Ln) and (Lc)) Grass/clover ley (6-year) 1981-1986 (blocks 1 & 3), 1981-1987 (blocks 2 & 4); became Lc (former (Lc)) or F (former (Ln))
(Dg25)	FYM at 25 t/ha annually 2003-2022; became F
(F)	No organic input 2003-2022; became AD

Notes

- (Dg25) received no PKS fertilisation (2003-2022).
- In 2003, F and CC treatments received 120 kg N, St received 90 kg N, and Dg10 received 60 kg N; no N was applied to Dg25, Co, or Lc treatments.

Current inorganic applications

Basal fertilisation

P	20 kg P as Triple Superphosphate in early Spring
KS	83 kg K + 36 kg S as Potassium Sulphate in early Spring
Liming	5 t/ha chalk to all plots every five years (last applied Spring 2022, next due Spring 2027)

Nitrogen fertilisation (kg N/ha) as calcium ammonium nitrate (Nitro-chalk; 27 % N), applied in Spring

Crop	N0	N1	N2	N3	N4	N5
w. wheat	0	50	100	150	200	250
forage maize	0	50	100	150	200	250
s. barley	0	35	70	105	140	175
w. rye	0	30	60	90	120	150
w. beans	0					

Notes

- **Winter wheat** receives 50 kg N in late February/early March, and the remainder in mid-April.
- **Forage maize** receive 50 kg N to the seedbed (late February/early March), and the remainder post-emergence in mid-April.
- **Spring barley** and **winter rye** receive N as a single dressing (April).
- No N applied to **winter beans** (plots are not split for N).
- No N is applied to **Lc** (grass-clover leys).
- N applications cycle N5 > N4 > N3 > N2 > N1 > N0 > N5 > ...

FARM DIARY

Date		Application	Rate	Units
-		Applied: Triple Superphosphate: all Plots	-	kg/ha
-		Applied: Sulphate of Potash: all Plots	-	kg/ha
09/11/2022	f	Applied: Anaerobic Digestate by hand; Plots 02, 16, 20, 25	30	t/ha
09/11/2022	f	Applied: Compost by hand; Plots 07, 12, 21, 27	40	t/ha
09/11/2022	f	Applied: Straw by hand; Plots 03, 15, 17, 31	7.5	t/ha
09/11/2022	f	Applied: Farmyard Manure (FYM) by hand; Plots 08, 14, 18, 28	10	t/ha
22/11/2022	a	Topped using Topper 9 with JD6145R Premium	-	-
22/11/2022	a	Ploughed using Dowdeswell 4 Furrow Plough with JD6145R Premium	-	-
28/11/2022	a	Ploughed using Dowdeswell 4 Furrow Plough with JD6145R Premium	-	-
01/12/2022		Drilled: Rye (Mephisto) using WES Accord 4m Tine Drill with JD6830	350	seeds/m2
11/12/2022	a	Operation: Power harrow	-	-
14/05/2023	p	Sprayed: Horus (16216) using Agribuggy2 AB30	1.2	L/ha
14/05/2023	p	Sprayed: Eagle (16490) using Agribuggy2 AB30	40	g/ha
14/05/2023	p	Sprayed: Biopower (A0617) using Agribuggy2 AB30	1	L/ha
22/05/2023	f	Applied: Nitrochalk by hand using; Subplots 021, 036, 046, 055, 063, 072, 083, 092, 104, 113, 124, 143, 153, 166, 173, 186, 195, 206, 212, 222, 232, 253, 265, 274, 286, 303, 313, 324	111	kg/ha
22/05/2023	f	Applied: Nitrochalk by hand using; Subplots 022, 035, 043, 056, 062, 071, 082, 095, 105, 112, 121, 144, 156, 164, 175, 182, 194, 205, 214, 225, 231, 255, 263, 271, 284, 302, 315, 326	222	kg/ha
22/05/2023	f	Applied: Nitrochalk by hand using; Subplots 025, 033, 044, 054, 064, 076, 085, 091, 102, 111, 123, 142, 154, 162, 176, 181, 192, 201, 211, 223, 236, 252, 262, 273, 283, 305, 312, 323	333	kg/ha
22/05/2023	f	Applied: Nitrochalk by hand using; Subplots 023, 034, 042, 051, 061, 074, 086, 094, 103, 114, 125, 141, 152, 165, 172, 183, 191, 204, 216, 221, 234, 254, 264, 275, 281, 306, 316, 321	444	kg/ha
22/05/2023	f	Applied: Nitrochalk by hand using; Subplots 026, 031, 041, 052, 066, 075, 081, 096, 101, 115, 122, 145, 151, 161, 174, 184, 196, 203, 213, 224, 233, 251, 261, 276, 285, 301, 314, 322	556	kg/ha
14/06/2023	p	Sprayed: Lentyma XE (19301) using Agribuggy2 AB30 ; Arable Plots.	0.9	L/ha
14/06/2023	p	Sprayed: Sprinter using Agribuggy2 AB30; Arable Plots	3	L/ha
20/06/2023	a	Harvest (Grass Leys) - 1 st Cut using Amazone Grass Harvester - Flail Mower Collector with JD5070; Plots 01, 13, 24, 29	-	-
22/08/2023	a	Harvest; Arable Plots; Haldrup C-85 2m cut	-	-
29/11/2023	a	Harvest (Grass Leys) - 2 nd Cut using Amazone Grass Harvester - Flail Mower Collector with JD5070; Plots 01, 13, 24, 29	-	-

Notes

- There are no records of basal TSP and SOP application and hence there may not have been any P, K or S applied.
- Samples of grain and grass-clover ley (1st and 2nd Cut) were taken for chemical analysis.
- Grain quality analyses completed on all grain samples.
- Soil sampling for chemical analysis and archiving: ((Ln)(Ln6)(F) AD and (Dg)(Dg25) F treatments only; 8 plots); 0-23, 23-38, and 38-53 cm depth; 14/09/2023.

YIELDS

WINTER RYE: GRAIN YIELD (t/ha; 85% DM) (Means)

Treatment / N	N0 0 kg	N1 30 kg	N2 60 kg	N3 90 kg	N4 120 kg	N5 150 kg	Mean
(Fd) F	0.541	0.643	0.711	0.852	0.748	0.788	0.714
(Dg) (Dg25) F	0.836	1.091	1.077	1.160	1.074	1.253	1.082
(St) St	0.549	0.592	0.588	0.703	0.712	0.622	0.628
(Gm) (Lc8) CC	0.617	0.666	0.853	0.876	0.921	0.759	0.782
(Pt) (Lc8) Co	0.962	0.949	1.044	0.802	0.839	0.840	0.906
(Fs) Dg10	0.615	0.769	0.694	0.819	0.862	0.786	0.758
(Ln) (Lc6) (F) AD	0.752	0.727	0.766	0.905	1.141	1.114	0.901
Mean	0.696	0.777	0.819	0.874	0.900	0.880	0.824
Grain mean DM%							86.7

Notes

- Plots 213 ((Pt) (Lc8) Co; N5) and 211 ((Pt) (Lc8) Co; N3) double-harvested by mistake – yield set to missing and estimated within the ANOVA algorithm.
- Plot 173 ((St) St; N1) used the second weight. There is no official note about what happened but most likely there was a need to weigh the sample again (probably a bit of trapped grain that was slow to come through). If there had been a problem with the weight, there would be a note to discard the second sample.

GRASS-CLOVER LEYS (1ST AND 2ND CUTS): DRY MATTER YIELD (t/ha) (Means)

Cut	1 st Cut (20/06/2023)	2 nd Cut (29/11/2023)	Total of 2 Cuts
Mean dry matter yield	2.03	1.04	3.07
Mean DM %	38.6	20.6	29.6

Grass-Clover Leys: mean dry matter yield since 2003

Year	1 st Cut	2 nd Cut	Total
2003	-	-	-
2004	1.82	-	1.82
2005	1.86	0.13	1.99
2006	4.07	-	4.07
2007	3.12	1.36	4.48
2008	5.72	1.65	7.37
2009	4.77	-	4.77
2010	4.41	-	4.41
2011	1.46	0.39	1.85
2012	4.11	0.64	4.75
2013	4.65	0.60	5.24
2014	4.09	0.91	5.01
2015	-	0.36	-
2016	3.97	0.56	4.54
2017	2.17	1.48	3.65
2018	2.98	0.93	3.91
2019	2.34	0.39	2.73
2020	1.01	-	-
2021	3.33	1.29	4.63
2022	2.11	0.09	2.19