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



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2023/R/PG/5 - Park Grass

Rothamsted Research

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2023/R/PG/5 PARK GRASS

Object: To study the effects of organic manures and inorganic fertilisers and lime on old grass for hay. The original objective focus on nutrients began to be compromised when it was discovered that use of one of the N fertilisers caused acidification of the soil. A small amount of chalk was applied to all plots during tests in the 1880s and 1890s to correct this. A regular test of liming was started in 1903 when most plots were divided in two with 4 t/ha CaCO₃ applied every four years to the southern half (L) with the northern half remaining unlimed (U). In 1965, most plots were divided into four: sub-plots "a" and "b" on the previously limed southern half (L) and sub-plots "c" and "d" on the unlimed northern half (U). Sub-plots "a", "b" and "c" now receive bespoke amounts of chalk, when necessary, to achieve or maintain soil pH (0-23 cm) at 7, 6 and 5, respectively. Sub-plot "d" remains unlimed and its pH reflects inputs from the various treatments and the atmosphere. A separate scheme of liming was introduced on plots 18, 19 and 20 in 1920; sub-plots /1, /2 and /3 received no lime, "high" lime and "light" lime respectively every 4 years. Since 1965 plot 18-1 has been split into two for treatments "c" and "d" as above and plot 18-3 split into two for treatments "a" and "b". Plots 19 and 20 received no further chalk after 1968; plot 18/2 received no further chalk after 1972. Chalk was last applied in 2021; the tenth application in a triennial scheme of soil pH analysis and remedial chalk applications. This note was occasionally incorrect in earlier Yield Book entries. 2023 was the 168th year, hay. The grass is cut twice annually: June (for making hay) and October (second cut). For previous years see 'Details' 1977 and 1973 and Yield Books for 1974-2022/R/PG/5.

Treatments

Main Plots

Plot	Current treatment	Previous treatments, where different
1	N1	
2/1	K	As 2/2 until 1995; K since 1996 (Plot 2 split into 2/1 and 2/2 from 1996)
2/2	None	FYM until 1863 (Plot 2 split into 2/1 and 2/2 from 1996)
3	None	
4/1	P	
4/2	N2P	
6	N1PKNaMg	
7/1	(P)KNaMg	Included P until 2012 (Plot 7 split into 7/1 and 7/2 from 2013)
7/2	PKNaMg	Plot 7 split into 7/1 and 7/2 from 2013
8	PNaMg	
9/1	(N2)PKNaMg	Included N2 until 1989
9/2	N2PKNaMg	
10	N2PNaMg	
11/1	N3PKNaMg	
11/2	N3PKNaMgSi	
12	None	
13/1	(FYM/F)	FYM/F until 1993/1995 (none since 1996)
13/2	FYM/PM	FYM/F until 1999
14/1	(N*2)PKNaMg	Included N*2 until 1989
14/2	N*2PKNaMg	
15	N*3PKNaMg	N*2 until 1875; P K Na Mg 1876-2012
16	N*1PKNaMg	
17	N*1	
18	N2KNaMg	
19	FYM	
20	FYM/N*P*K*	

Current and Previous treatment codes

N1, N2, N3	48, 96, 144 kg N as sulphate of ammonia (21% N; 24% S)
N*1, N*2, N*3	48, 96, 144 kg N as nitrate of soda (16% N; 27% Na)
N*	30 kg N as nitrate of soda (16% N; 27% Na) to Plot 20 in years when it does not receive FYM
P	17 kg P applied as triple superphosphate since 2017; 35 kg P as triple superphosphate in 1974 and since 1987; single superphosphate in other years
P*	15 kg N as triple superphosphate to Plot 20 in years when it does not receive FYM; 15 kg P as triple superphosphate in 1974 and since 1987; single superphosphate in other years
K	225 kg K as sulphate of potash
K*	45 kg K as sulphate of potash to Plot 20 in years when it does not receive FYM
Na	15 kg Na as sulphate of soda
Mg	10 kg Mg as sulphate of magnesia (Epsom Salts)
Si	104 kg Si as silicate of soda
FYM	Farmyard manure at 35 t (fresh weight) every fourth year; last applied 2021
PM	Pelleted poultry manure at 2 t (fresh weight), every fourth year since 2003 (to supply 63 kg N); applied in 2023
(F)	Fishmeal every fourth year until 1999 (to supply 63 kg N)

Sub-Plots

Sub-Plot	Liming
a	Ground chalk applied every 3 years as necessary to achieve pH7
b	Ground chalk applied every 3 years as necessary to achieve pH6
c	Ground chalk applied every 3 years as necessary to achieve pH5
d	Unlimed

Notes

Main Plots 1-18 divided into a, b, c, d (i.e., all plots except 18/2, 19 and 20).

FARM DIARY

Date		Application	Rate	Units
31/01/2023	f	Applied Triple Superphosphate (TSP) using Nordsten 3m fertiliser box with JD5070; Plots: 4/1, 4/2, 6, 7/2, 8, 9/1, 9/2, 10, 11/1, 11/2, 14/1, 14/2, 15, 16	84.7	kg/ha
01/02/2023	f	Applied Triple Superphosphate (TSP) by Hand: Plots: 20/1, 20/2, 20/3	74.7	kg/ha
07/02/2023	f	Applied: Sulphate of Soda using Quick Pass with JD5070: Plots: 6, 7/1, 7/2, 8, 9/1, 9/2, 10, 11/1, 11/2, 14/1, 14/2, 15, 16, 18, 18/2	43	kg/ha
07/02/2023	f	Applied: Sulphate of Magnesia (Epsom Salts) using Quick Pass with JD5070: Plots: 6, 7/1, 7/2, 8, 9/1, 9/2, 10, 11/1, 11/2, 14/1, 14/2, 15, 16, 18, 18/2	111	kg/ha
07/02/2023	f	Applied: Sulphate of Potash (SOP) using Quick Pass with JD5070: Plots: 2/1, 6, 7/1, 7/2, 9/1, 9/2, 11/1, 11/2, 14/1, 14/2, 15, 16, 18, 18/2	542	kg/ha
08/02/2023	f	Applied: Sulphate of Potash (SOP) using By Hand with Pedestrian Operated: Plots: 20/1, 20/2, 20/3	108	kg/ha
08/02/2023	f	Applied Silicate of Soda: Plot 11/2	450	kg/ha
08/02/2023	f	Applied: Poultry Manure by Hand; Plot 13/2	2	t/ha
02/05/2023	f	Applied: Sulphate of Ammonia using Exactomatic with JD5070: Plots: 9/2, 10	459	kg/ha
02/05/2023	f	Applied: Sulphate of Ammonia using Exactomatic with JD5070: Plots: 11/1, 11/2	686	kg/ha
03/05/2023	f	Applied: Sulphate of Ammonia using Exactomatic with JD5070: Plots - 1, 6a, 6b	229	kg/ha
03/05/2023	f	Applied: Sulphate of Ammonia using Exactomatic with JD5070: Plots: 4/2, 9/2, 10, 18, 18/2	459	kg/ha
02/05/2023	f	Applied: Sodium Nitrate by Hand; Plots 16, 17	300	kg/ha
02/05/2023	f	Applied: Sodium Nitrate by Hand; Plot 14/2	600	kg/ha
02/05/2023	f	Applied: Sodium Nitrate by Hand; Plot 15	900	kg/ha
02/05/2023	f	Applied: Sodium Nitrate by Hand; Plots 20/1, 20/2, 20/3	188	kg/ha
22/06/2023	a	Park Grass (1st Cut): Amazone Grass Harvester - Flail Mower Collector with JD5070	-	-
24/06/2023	a	Tedding/Spreading grass: Tedder with JD6145R Premium	-	-
27/06/2023	a	Rowing up: Claas Windrower with JD6230	-	-
27/06/2023	a	Harvest (Bale Weights): McHale Fusion 2 Baler with JD6145R Premium	-	-
25/10/2023	a	Park Grass (2nd CUT): Amazone Grass Harvester - Flail Mower Collector with JD5070	-	-
06/11/2023	a	Mowing: McHale Pro Glide R3100 with JD6145R	-	-
07/11/2023	a	Harvest (Bale Weights): McHale Fusion 2 Baler with JD6145R Premium	-	-
07/11/2023	a	Rowing up: Claas Windrower with JD6230	-	-

Notes

- TSP applications of 84.7 and 74.7 kg/ha were as close as possible to target rates (83 and 73 kg/ha, respectively) based on calibration of spreader.
- Sulphate of Ammonia application of 459 kg/ha was as close as possible to target rate (457 kg/ha, respectively) based on calibration of spreader.
- Samples of herbage (1st and 2nd Cut) were taken for chemical analysis. Unground herbage samples from all plots were archived.
- Soil sampling for chemical analysis and archiving:
 - all plots; 0-23 cm depth; 06-07/03/2023
 - some 'd' sub-plots: 1d, 4/2d, 9/1d, 9/2d, 10d, 11/1d, 11/2d, 18d; 0-4 cm 'mat' and 4-23 cm 'mineral' depths; 07/03/2023

YIELDS**GRASS HERBAGE: 1st CUT (22-23/06/2023): DRY MATTER YIELD (t/ha)**

Plot	Treatment	Lime				Mean
		a	b	c	d	
1	N1	1.96	2.29	1.37	0.66	1.57
2/1	K	3.65	2.49	1.96	1.40	2.38
2/2	None	3.80	2.01	1.64	1.26	2.18
3	None	2.46	2.49	1.69	1.18	1.96
4/1	P	3.91	3.72	2.49	2.50	3.16
4/2	N2P	4.31	4.65	4.47	2.29	3.93
6	N1PKNaMg	7.77	7.68	-	-	7.73
7/1	(P)KNaMg	6.50	7.55	3.82	2.37	5.06
7/2	PKNaMg	7.19	6.75	3.98	2.83	5.19
8	PNaMg	3.86	4.39	2.80	2.37	3.35
9/1	(N2)PKNaMg	6.57	6.48	5.54	1.43	5.00
9/2	N2PKNaMg	7.33	7.65	7.39	3.73	6.53
10	N2PNaMg	4.70	5.67	5.70	3.20	4.82
11/1	N3PKNaMg	7.27	7.08	6.95	1.48	5.69
11/2	N3PKNaMgSi	7.86	7.87	7.88	3.31	6.73
12	None	3.69	2.57	2.92	2.45	2.91
13/1	(FYM/F)	3.87	4.59	4.94	4.68	4.52
13/2	FYM/PM	3.05	5.88	5.60	7.00	5.38
14/1	(N*2)PKNaMg	7.71	5.36	4.31	5.72	5.78
14/2	N*2PKNaMg	8.93	5.90	6.96	8.29	7.52
15	N*3PKNaMg	7.83	6.70	9.29	7.07	7.72
16	N*1PKNaMg	6.77	5.78	4.51	5.04	5.53
17	N*1	2.90	2.66	2.29	2.44	2.57
18	N2KNaMg	4.25	3.59	2.54	2.03	3.10
18/2	N2KNaMg					3.93
19/1	FYM					6.01
19/2						6.32
19/3						6.88
20/1	FYM/N*P*K*					5.91
20/2						6.08
20/3						6.45
Mean						4.62
1st cut mean DM%						34.2

Notes

- Plots 11/1d and 11/2d brown. Suspected cause was that plants are already under stress because of the extreme acid conditions (a treatment effect) which has been exaggerated by the extreme weather (drought, snow, etc). A similar observation has been made in earlier years. Aerial photographs were taken by drone on 04/05/2023. However, yield recovered.
- Plot 19/3, cut strip 1 error message "Jam no good"; yield excluded.

GRASS HERBAGE: 2ND CUT (25-26/10/2023): DRY MATTER YIELD (t/ha)

Plot	Treatment	Lime				Mean
		a	b	c	d	
1	N1	1.60	1.85	2.10	1.16	1.68
2/1	K	2.01	2.22	1.81	1.77	1.95
2/2	None	2.12	1.45	2.84	1.80	2.05
3	None	1.82	2.06	2.46	1.54	1.97
4/1	P	1.79	2.29	2.72	2.32	2.28
4/2	N2P	2.56	2.65	3.01	2.48	2.68
6	N1PKNaMg	1.55	1.57	-	-	1.56
7/1	(P)KNaMg	2.12	2.27	2.42	1.36	2.05
7/2	PKNaMg	1.73	1.85	2.42	1.74	1.93
8	PNaMg	1.93	1.93	2.51	2.27	2.16
9/1	(N2)PKNaMg	0.86	1.61	2.01	0.97	1.36
9/2	N2PKNaMg	2.43	3.04	2.78	3.27	2.88
10	N2PNaMg	3.05	2.97	2.78	3.11	2.98
11/1	N3PKNaMg	3.00	2.54	2.71	2.77	2.76
11/2	N3PKNaMgSi	3.57	1.50	2.49	4.99	3.14
12	None	2.07	1.85	2.67	2.27	2.22
13/1	(FYM/F)	1.85	3.01	3.36	3.06	2.82
13/2	FYM/PM	1.72	3.14	3.29	2.22	2.59
14/1	(N*2)PKNaMg	2.51	3.14	3.64	2.61	2.97
14/2	N*2PKNaMg	3.34	3.08	3.11	3.84	3.34
15	N*3PKNaMg	3.08	3.26	3.49	2.87	3.18
16	N*1PKNaMg	3.02	3.15	3.21	2.67	3.01
17	N*1	2.28	2.91	3.80	2.97	2.99
18	N2KNaMg	2.81	2.72	1.96	1.80	2.32
18/2	N2KNaMg					3.06
19/1	FYM					3.16
19/2						3.64
19/3						2.67
20/1	FYM/N*P*K*					2.60
20/2						0.97
20/3						1.29
Mean						2.47
2 nd cut mean DM%						23.1

Notes

- Plots 11/1d and 11/2d brown. Suspected cause was that plants are already under stress because of the extreme acid conditions (a treatment effect) which has been exaggerated by the extreme weather (drought, snow, etc). A similar observation has been made in earlier years. Aerial photographs were taken by drone on 04/05/2023. However, yield recovered.
- Cut 2: 4 missing (excluded) yield strips due to blockage in mower from grass being too wet: plot 9/2b, cut strip 2 (10.27); 11/2b, cut strip 1 (8.789); plot 11/2d, cut strip 2 (11.59); plot 13/2c, cut strip 1 (1.5). Also, only one strip for plot 20/1 - probably an issue with a blockage in the mower but no notes made.

GRASS HERBAGE: TOTAL OF 2 CUTS: DRY MATTER YIELD (t/ha)

Plot	Treatment	Lime				Mean
		a	b	c	d	
1	N1	3.56	4.14	3.47	1.82	3.25
2/1	K	5.66	4.71	3.78	3.17	4.33
2/2	None	5.92	3.46	4.48	3.06	4.23
3	None	4.28	4.55	4.15	2.71	3.92
4/1	P	5.70	6.02	5.20	4.83	5.44
4/2	N2P	6.86	7.30	7.48	4.76	6.60
6	N1PKNaMg	9.32	9.26	-	-	9.29
7/1	(P)KNaMg	8.62	9.83	6.25	3.73	7.11
7/2	PKNaMg	8.92	8.60	6.40	4.57	7.12
8	PNaMg	5.78	6.31	5.31	4.64	5.51
9/1	(N2)PKNaMg	7.43	8.10	7.55	2.39	6.37
9/2	N2PKNaMg	9.76	10.69	10.17	7.00	9.41
10	N2PNaMg	7.75	8.65	8.48	6.31	7.80
11/1	N3PKNaMg	10.28	9.62	9.66	4.25	8.45
11/2	N3PKNaMgSi	11.43	9.37	10.37	8.30	9.87
12	None	5.76	4.42	5.59	4.73	5.12
13/1	(FYM/F)	5.73	7.60	8.30	7.74	7.34
13/2	FYM/PM	4.78	9.03	8.89	9.22	7.98
14/1	(N*2)PKNaMg	10.22	8.50	7.95	8.33	8.75
14/2	N*2PKNaMg	12.27	8.98	10.07	12.13	10.86
15	N*3PKNaMg	10.91	9.96	12.78	9.94	10.90
16	N*1PKNaMg	9.79	8.93	7.72	7.71	8.54
17	N*1	5.18	5.57	6.09	5.41	5.56
18	N2KNaMg	7.06	6.30	4.49	3.83	5.42
18/2	N2KNaMg					6.99
19/1	FYM					9.17
19/2						9.96
19/3						9.55
20/1	FYM/N*P*K*					8.51
20/2						7.05
20/3						7.74
Mean						7.09
2 nd cut mean DM%						28.6

Notes

- Plots 11/1d and 11/2d brown. Suspected cause was that plants are already under stress because of the extreme acid conditions (a treatment effect) which has been exaggerated by the extreme weather (drought, snow, etc). A similar observation has been made in earlier years. Aerial photographs were taken by drone on 04/05/2023. However, yield recovered.
- Plot 19/3, 1st cut, cut strip 1 error message "Jam no good"; yield excluded.
- 2nd cut: 4 missing (excluded) yield strips due to blockage in mower from grass being too wet: plot 9/2b, cut strip 2 (10.27); 11/2b, cut strip 1 (8.789); plot 11/2d, cut strip 2 (11.59); plot 13/2c, cut strip 1 (1.5). Also, only one strip for plot 20/1 - probably an issue with a blockage in the mower but no notes made.