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Results of the Classical and Other Long-term Experiments 2021

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Rothamsted Research

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

Object: To study, from crop yields and soil analyses, the effects of a range of types of organic matter – Woburn, Stackyard B.

The 57th year, Winter Beans.

For previous years see 'Details' 1973 and Yield Books for 74-20/W/RN/12.

Design: 4 blocks of 8 plots

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 five levels of N and nil. 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. 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.

Whole plots

1. **Treatment** (Not necessarily applied each year):

1966-1971/2	1979/82-1986/7	Since 2003
Fd	Fd	F
Ln	Lc6	F
St	St	St
Gm	Lc8	CC
Pt	Lc8	Co
Fs	Fs	Dg10
Dg	Dg	Dg25
Lc	Lc6	Lc

F: no organic amendment. St: chopped straw at 7.5 t/ha. CC: cover crop (white mustard) prior to spring sown crops. Co: compost at 40 t/ha. Dg10: FYM at 10 t/ha. Dg25: FYM at 25 t/ha. Dg: FYM at 50 t/ha. Fd: fertilizers equivalent to FYM. Fs: fertilizers equivalent to straw (+P). Lc/Lc6/Lc8: grass/clover leys. Ln: grass ley + N. Gm: green manure. Pt: peat. All application rates of organics are on a fresh weight basis.

Since 2003, all treatments, except Dg25, have also received PKS fertilizers:

20 kg P/ha, 83 kg K/ha, 36 kg S/ha

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In addition, in 2003, F and CC treatments received 120 kg N/ha, St received 90 kg N/ha. Dg10 received 60 kg N/ha. No N was applied to Dg25, Co or Lc treatments.

Nitrogen

In 2008 all plots, except Lc (permanent grass/clover), split into 6 to test rates of N, except for when under winter beans (when no N is applied). For crops receiving N rates rotate as follows:

N5 > N4 > N3 > N2 > N1 > N0 > N5 etc.

The N0-N5 application rate (per hectare, all applied as Nitro-Chalk 27%N) for each crop are, respectively:

winter rye	0, 30, 60, 90, 120, 150 kg N
spring barley	0, 35, 70, 105, 140, 175 kg N
winter wheat / forage maize	0, 50, 100, 150, 200, 250 kg N

Experimental Diary

Date		Application	Rate	Units
25/10/2020	p	Sprayed using Knight 24m Sprayer, NH T6030: Samurai (16238)	2.5	L/ha
26/10/2020	a	Topping; Topper 9, JD6620	-	-
28/10/2020	f	Applied Farmyard Manure (FYM) by hand: Plots 005, 011, 023, 026	25	t/ha
28/10/2020	f	Applied Farmyard Manure (FYM) by hand: Plots 008, 014, 018, 028	10	t/ha
29/10/2020	f	Applied Straw by hand: Plots 003, 015, 017, 031	7.5	t/ha
29/10/2020	f	Applied Compost by hand: Plots 007, 012, 021, 027	40	t/ha
04/11/2020	a	Topping; WES Topper 9, WES 3m Front Topper, JD6620: Straw Plots	-	-
04/11/2020	a	Ploughed Tillage 20 cm using WES Dowdeswell 100 Series Five Furrow Plough JD6620: Thrown E	-	-
13/11/2020	a	Power Harrow using WES Power Harrow, JD6620	-	-
24/11/2020	s	Drilled using WES Accord 4m Tyne Drill, JD6620: KWS Zyatt	400	seeds/m^2
24/02/2021	a	Topping using Topper 9, JD6620: Grass Plots	-	-
28/04/2021	a	Minimum Tillage 5 cm using Kilworth Power Harrow 1.3 m, Iseki ISTH4335: Marking paths	-	-
05/05/2021	f	Applied Nitrochalk; All Plots except Plots 001, 013, 024, 029	185	kg/ha
05/05/2021	f	Applied Nitrochalk; Sub Plots 024, 032, 045, 053, 065, 073, 084, 093, 106, 116, 126, 146, 155, 163, 171, 185, 193, 202, 215, 226, 235, 256, 266, 272, 282, 304, 311, 325	185	kg/ha
05/05/2021	f	Applied Nitrochalk; Sub Plots 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	370	kg/ha
05/05/2021	f	Applied Nitrochalk; Sub Plots 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	556	kg/ha
05/05/2021	f	Applied Nitrochalk; Sub Plots 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	741	kg/ha
07/05/2021	f	Applied Sulphate of Potash (SOP) using Cascade Spreader, JD6620; All plots except 005, 011, 023, 026	200	kg/ha

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07/05/2021	f	Applied Triple Superphosphate (TSP) using Cascade Spreader, JD6620; All plots except 005, 011, 023, 026	97.5	kg/ha
18/05/2021	p	Sprayed using WES 12m Knight Sprayer, WES MF6150: Sprinter - ????	2	L/ha
18/05/2021	p	Sprayed using WES 12m Knight Sprayer, WES MF6150: Ally Max SX (18768)	42	g/ha
18/05/2021	p	Sprayed using WES 12m Knight Sprayer, WES MF6150: Lentyma XE (19301)	1	L/ha
18/05/2021	p	Sprayed using WES 12m Knight Sprayer, WES MF6150: Starane HI-Load HL (16557)	0.4	L/ha
23/06/2021	a	Harvest: 1st Cut Grass Plots	-	-
30/06/2021	a	Mowing grass plots using Mower-Unifarm CM166, JD6620	-	-
30/06/2021	a	Topping using WES Topper 9, JD6620	-	-
30/06/2021	a	Baling Grass	-	-
09/08/2021	a	Topping using WES Topper 9, JD6620	-	-
20/08/2021	a	Harvest using Haldrup C-85 2m cut	-	-
24/08/2021	a	Harvested discard areas using Haldrup C-85 2m cut	-	-
02/09/2021	a	Baling using Claas Baler, JD6620	-	-
02/09/2021	a	Topping using WES Topper 9, JD6620	-	-
22/11/2021	a	Harvest: Second Cut Grass Plots	-	-
25/11/2021	a	Topping using WES Topper 9, JD6620	-	-
25/11/2021	a	Baling	-	-

Yields

WINTER WHEAT

N	0	50	100	150	200	250	Mean
ROTATION							
F(Fd)	0.61	2.39	2.73	2.33	2.51	2.45	2.17
F(Ln,Lc6)	0.76	2.25	2.13	1.31	1.72	2.03	1.70
St(St)	0.63	1.76	2.17	2.33	2.13	1.79	1.80
CC(Gm,Lc8)	0.67	1.99	2.83	2.63	2.68	2.52	2.22
Co(Pt,Lc8)	1.71	3.14	3.16	3.09	2.93	3.34	2.89
Dg10(Fs)	0.87	2.51	2.29	2.08	2.44	2.69	2.15
Dg25(Dg)	1.24	3.33	2.91	2.96	3.33	2.59	2.73
Mean	0.93	2.48	2.60	2.39	2.53	2.49	2.24
Grain mean DM%	83.80						

GRASS/CLOVER

DRY MATTER TONNES/HECTARE
***** Table of means *****

Year	1st Cut	2nd 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

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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

Cut dry matter t/ha (23 JUNE 2021 AND 22 NOVEMBER 2021).

Note: Herbage samples were taken for chemical analyses and archiving.

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