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Results of the Classical and Other Long-term Experiments 2022

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Rothamsted Research

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22/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 58th year, Forage Maize.

For previous years see 'Details' 1973 and Yield Books for 74-21/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 (number indicates years). 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

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.

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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

For winter wheat, N application is split: 50 kg is applied in February/March and the remainder is applied in mid-April.

For forage maize, N application is split: 50 kg is applied to the seedbank and the remainder is applied post-emergence.

Experimental Diary

Date		Application	Rate	Units
25/09/2021	a	Power harrow 10 cm using WES Power Harrow, JD6620		
28/10/2021	s	Drilled using WES Accord 4m Tyne Drill, JD6620: Zlata (White Mustard): Plots 04, 10, 19, 32	10	kg/ha
25/11/2021	a	Mowed using JD6620n 2022/R/RN/12		
07/03/2022	f	Applied using By Hand: Farmyard Manure (FYM): Plots 08, 14, 18, 28	10	t/ha
08/03/2022	f	Applied using By Hand: Farmyard Manure (FYM): Plots 05, 11, 23, 26	25	t/ha
08/03/2022	f	Applied using By Hand: Compost: Plots 07, 12, 21, 27	40	t/ha
14/03/2022	f	Applied using By Hand: Straw into Stackyard Woburn: Plots 03, 15, 17, 31	7.5	t/ha
15/03/2022	a	Topped using WES Topper 9, JD6620		
15/03/2022	a	Plough using WES Dowdeswell 100 Series Five Furrow Plough, JD683020 cm; thrown NW		
12/05/2022	s	Drilled using WES Accord 4m Tyne Drill, JD6830: Maize (Augustus) with seed dressing Redigo Pro	9	seeds/m2
16/05/2022	f	Applied using: Nitro-Chalk (Basal) to all N1-N5 subplots	185	kg/ha
16/05/2022	f	Applied using: Nitro-Chalk to N2 subplots	185	kg/ha
16/05/2022	f	Applied using: Nitro-Chalk to N3 subplots	370	kg/ha
16/05/2022	f	Applied using: Nitro-Chalk to N4 subplots	556	kg/ha
16/05/2022	f	Applied using: Nitro-Chalk to N5 subplots	741	kg/ha
20/06/2022	p	Sprayed using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor: Callisto (12323)	1.5	L/ha
20/06/2022	p	Applied using WES 12m Knight Sprayer, WES MF6150 - Spraying Tractor (440 g/L P, 75 g/L K_2O, 46 g/L Zn, 66 g/L MgO): Maize Boost	5	L/ha
24/06/2022	a	Harvest using Amazone Grass Harvester - Flail Mower Collector, Iseki ISTH4335 - 1st Cut; Plots 01, 13, 24, 29		
28/06/2022	a	Mowed - using Amazone Grass Harvester - Flail Mower Collector, JD5070; Cleared		
20/10/2022	a	Harvest: Maize		
05/01/2023	a	Harvest using Amazone Grass Harvester - Flail Mower Collector, Iseki ISTH4335 – 2nd Cut; Plots 01, 13, 24, 29		

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Yields

FORAGE MAIZE

DRY MATTER TONNES/HECTARE

N	0	50	100	150	200	250	Mean
ROTATION							
F(Fd)	4.58	5.92	5.23	4.85	5.22	5.67	**5.25**
F(Ln,Lc6)	6.67	7.02	7.94	6.60	6.90	9.16	**7.38**
St(St)	6.71	7.12	8.41	7.99	8.59	7.90	**7.79**
CC(Gm,Lc8)	5.81	8.02	7.73	7.39	5.74	5.24	**6.65**
Co(Pt,Lc8)	6.95	8.30	6.57	7.96	6.40	6.93	**7.18**
Dg10(Fs)	8.70	9.24	9.01	11.52	10.38	10.67	**9.92**
Dg25(Dg)	8.29	9.62	7.64	8.40	8.90	8.87	**8.62**
Mean	**6.82**	**7.89**	**7.50**	**7.82**	**7.45**	**7.78**	**7.54**
Grain mean DM%	39.20						

GRASS/CLOVER

DRY MATTER TONNES/HECTARE

***** Table of means *****

Year	1st Cut	2nd Cut	Total of 2 cuts
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**

Cut dry matter t/ha (24/06/2022 and 05/01/2023).

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