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**Supplementary Table 1** Woburn Ley-arable. Yields of winter wheat grain, t ha<sup>-1</sup> at 85% dry matter

Rotation	Fertiliser N applied <sup>a</sup> kg ha <sup>-1</sup>	Year and block										
		1981		1982		1983		1984		1985		1986
		III		V		IV		II		I		II
		No FYM	FYM residues <sup>b</sup>	No FYM	FYM residues	No FYM	FYM residues	No FYM	FYM residues	No FYM	FYM residues	No FYM
AB	0	3.24	4.43	3.44	5.50	3.98	4.24	3.85	3.46	2.60	2.17	3.41
	70	6.42	6.75	5.94	6.82	5.82	6.74	6.41	6.70	6.39	5.41	6.73
	140	7.30	7.68	8.12	7.52	8.53	8.87	8.18	7.30	8.35	7.17	8.20
	210	6.61	8.16	8.19	8.06	8.25	8.09	9.63	9.18	8.23	9.00	8.75
AF	0	2.78	3.35	4.41	4.19	4.01	3.51	4.02	4.54	1.89	2.16	4.32
	70	6.24	6.40	7.52	6.11	7.16	6.42	10.14	7.74	5.68	5.24	5.30
	140	7.16	8.05	8.31	8.02	8.29	8.71	9.58	8.66	7.80	7.63	5.79
	210	7.20	8.37	8.48	8.56	9.58	9.28	9.67	9.04	9.30	9.09	7.14
Ln3	0	5.82	5.82	5.95	4.78	3.61	4.10	5.16	4.67	4.33	4.15	4.28
	70	7.69	7.34	7.96	7.86	6.74	7.36	7.56	7.76	7.02	7.50	6.67
	140	8.16	8.07	7.59	7.46	7.40	8.71	11.10	8.39	8.33	8.19	6.75
	210	7.55	7.26	8.39	8.54	8.07	8.49	11.87	8.83	10.99	8.38	6.40
Ln8	0	4.05	5.38	5.59	5.50	4.99	3.91	5.61	5.32	4.10	4.05	4.36
	70	6.66	6.39	7.90	8.17	7.23	7.23	8.55	8.81	7.14	6.81	5.80
	140	7.94	8.13	8.27	8.27	7.31	7.65	9.67	8.72	8.56	8.21	7.26
	210	7.75	7.92	7.30	7.32	7.48	6.38	10.80	9.87	8.76	8.33	6.82
Lc3	0	5.38	5.32	5.38	4.93	5.85	6.86	8.37	6.00	5.25	4.68	5.88
	70	6.71	6.68	7.28	8.35	9.15	10.19	11.87	10.24	7.37	7.92	6.83
	140	7.28	8.11	8.43	8.33	9.32	9.36	10.28	10.75	9.39	9.74	6.09
	210	7.68	7.38	8.39	6.41	8.25	8.55	10.22	9.54	8.58	9.09	6.30
Lc8	0	6.23	6.71	6.17	6.96	7.21	7.56	7.13	7.89	4.48	4.39	5.71

70	7.75	7.92	8.42	8.29	8.79	10.49	9.34	9.97	8.56	7.61	7.26
140	8.31	7.66	8.64	8.56	8.95	8.65	10.67	11.41	8.68	8.83	6.88
210	7.68	7.68	7.92	8.89	7.95	9.37	9.92	8.81	10.70	9.67	6.32

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<sup>a</sup> N rates: 0, 63, 126, 189 kg ha<sup>-1</sup> in 1981 only.

<sup>b</sup> Residues of 38 t FYM ha<sup>-1</sup> applied every 5th year. Last applied in 1963, 1964, 1965, 1966 and 1967 to half of the plots in Block IV, II, I, III and V respectively (See Jol

86	1987		1988		1989		1990		1991		1992		1993
II	V		IV		II		I		III		V		IV
FYM residues	No FYM	FYM residues	No FYM	FYM residues	No FYM	FYM residues	No FYM	FYM residues	No FYM	FYM residues	No FYM	FYM residues	No FYM
4.94	4.58	4.19	2.84	3.12	0.91	1.42	1.84	1.09	4.02	4.93	6.40	6.23	3.22
7.09	5.67	6.68	6.01	6.56	3.20	4.68	6.09	3.78	8.07	9.05	7.63	8.05	6.11
6.21	5.77	7.73	6.59	6.95	4.58	4.58	5.79	5.86	10.01	9.88	7.23	7.18	6.28
8.30	7.32	8.35	5.35	7.05	4.14	5.34	6.32	6.34	9.89	10.58	5.56	8.07	6.23
3.84	2.82	3.22	3.39	2.79	2.99	2.61	1.21	1.55	2.63	4.30	4.38	3.27	2.71
4.87	5.15	5.98	6.93	6.27	5.59	4.26	5.89	5.56	7.51	8.48	8.22	7.87	5.77
6.84	6.20	7.01	6.70	6.55	5.63	4.71	5.77	6.83	9.44	10.06	8.36	8.07	7.20
8.62	6.57	6.28	6.32	6.89	5.80	5.84	6.34	4.01	10.31	10.82	8.52	6.67	7.33
2.45	4.52	4.29	3.94	4.08	4.23	3.86	1.67	1.79	7.61	5.88	2.27	3.18	3.04
4.63	6.32	6.79	6.14	7.40	5.31	6.57	4.71	5.18	8.87	8.83	6.10	6.85	5.65
6.50	7.43	7.74	6.89	7.34	7.04	5.16	4.82	6.03	10.39	9.53	6.86	8.11	6.70
5.70	7.33	6.92	6.05	6.22	6.23	5.84	6.51	5.83	10.21	10.61	7.57	6.95	6.56
4.99	4.93	4.66	4.13	4.55	3.46	4.08	2.07	3.17	5.81	6.07	4.14	4.25	3.27
7.30	6.76	6.71	6.52	6.93	5.45	5.70	5.47	6.12	9.03	8.63	7.18	7.16	5.22
7.14	7.75	7.97	7.49	7.42	5.65	5.48	5.56	4.59	9.95	9.32	7.22	7.85	6.32
6.86	7.72	6.28	7.02	7.44	4.36	5.46	4.35	6.15	9.69	9.81	7.33	6.00	6.38
6.39	5.55	5.47	5.41	5.96	5.83	5.07	3.44	3.74	6.12	6.82	6.75	5.92	6.02
7.47	7.06	7.41	7.27	7.52	6.22	6.34	6.44	5.69	9.36	9.38	7.65	7.32	7.04
7.69	8.01	7.47	7.42	7.65	5.80	6.44	7.56	6.85	10.30	10.62	6.34	5.92	7.52
6.11	7.91	7.32	7.19	7.84	5.64	5.98	7.02	5.82	10.26	10.70	5.09	4.49	7.77
6.46	4.94	5.58	6.04	4.48	4.47	5.35	3.42	3.21	6.33	5.83	7.12	7.10	5.83

7.35	6.84	8.12	8.57	7.17	6.15	7.24	7.04	5.99	8.75	8.88	7.05	6.25	7.35
6.83	8.59	8.04	6.99	6.88	6.72	6.06	6.92	6.38	9.42	9.83	6.95	5.96	7.40
7.18	8.27	7.98	7.41	6.72	5.07	5.04	7.08	6.91	10.01	10.20	6.62	5.66	7.51

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hnston *et al.*, 2022, for details).

Year and block													
93	1994		1995		1996		1997		1998		1999		2000
V	II		I		III		V		IV		II		I
FYM residues	No FYM	FYM residues	No FYM	FYM residues	No FYM	FYM residues	No FYM	FYM residues	No FYM	FYM residues	No FYM	FYM residues	No FYM
3.01	0.71	1.15	1.38	1.22	1.22	1.16	1.26	1.91	3.38	3.04	0.00	0.00	1.28
5.73	4.64	3.24	4.08	4.33	7.10	7.38	4.90	6.55	6.77	6.64	2.82	1.11	4.52
5.51	2.44	5.63	4.68	4.01	7.43	8.18	7.59	7.16	9.46	9.24	3.73	3.15	4.93
7.03	3.37	3.65	5.49	3.22	7.94	8.93	7.55	8.21	10.28	10.25	2.28	2.27	6.22
3.01	2.06	1.53	1.04	1.50	0.23	1.07	2.40	2.40	2.50	2.55	0.00	1.05	0.37
5.80	5.36	5.27	3.72	3.92	6.42	6.78	6.72	6.33	6.31	6.39	6.11	7.00	4.99
6.23	7.88	8.29	5.33	3.86	7.19	8.19	8.60	9.91	8.83	8.77	7.78	7.29	6.15
7.42	7.95	9.14	4.84	5.08	6.53	9.05	9.41	9.07	9.75	9.70	8.57	8.39	8.64
3.21	4.82	4.71	2.02	2.32	4.75	2.89	0.96	2.52	4.08	3.46	1.44	1.93	3.42
5.15	6.65	5.67	5.07	4.95	7.10	7.27	3.33	4.33	7.06	7.20	7.21	5.96	7.11
6.50	8.00	6.70	5.41	5.37	7.33	6.98	5.29	5.02	8.97	8.37	7.32	7.84	8.78
6.48	6.64	7.65	5.63	5.94	8.89	7.93	4.96	5.09	9.64	9.60	7.40	8.26	8.27
3.58	3.65	3.63	1.92	3.12	6.12	6.62	2.27	2.79	4.85	5.08	4.45	2.38	3.45
5.09	5.35	4.93	5.61	5.81	7.80	8.65	5.24	7.15	7.31	8.23	5.34	7.85	7.76
6.62	8.26	5.73	4.61	6.10	8.39	9.16	6.72	7.14	9.02	9.40	8.84	7.68	6.91
6.71	6.97	7.35	6.51	6.56	8.12	8.81	7.38	7.11	8.65	9.82	5.42	7.59	6.95
5.13	5.05	5.08	2.95	2.19	4.62	5.85	3.84	4.97	4.84	4.71	3.83	5.01	5.77
6.98	5.91	6.10	5.89	5.51	8.16	7.37	7.30	8.10	7.04	7.91	7.13	7.41	8.73
7.86	6.20	6.35	6.87	6.05	8.29	8.08	8.13	7.89	8.04	8.96	8.90	8.40	8.58
8.04	7.30	7.70	6.14	5.42	8.10	9.25	8.24	8.36	8.56	8.93	9.59	9.48	10.27
6.34	4.23	2.69	3.72	3.32	6.27	5.20	4.29	3.90	4.55	3.67	1.71	1.87	4.71

6.72	6.84	6.11	7.04	6.16	7.44	8.51	7.55	6.01	7.62	7.49	4.91	4.39	8.10
6.99	6.21	5.92	6.61	6.11	8.16	8.80	6.74	7.98	9.31	8.71	5.07	6.01	8.99
7.86	7.30	7.75	6.68	5.59	7.98	8.58	7.61	7.24	9.15	8.81	6.40	3.50	9.64

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FYM  
residues

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1.61

4.57

4.10

4.83

1.54

4.75

6.40

6.15

3.37

7.00

8.50

9.14

3.40

5.39

7.52

8.04

4.33

7.74

9.34

10.40

3.91



6.83

8.91

9.65

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**Supplementary Table 2** Woburn Ley-arable. Yields of spring barley grain, t ha<sup>-1</sup> at 85% dry matter

Rotation	Fertiliser N applied <sup>a</sup> kg ha <sup>-1</sup>	1982		1983		1984	
		III		V		IV	
		No FYM	FYM residues <sup>b</sup>	No FYM	FYM residues	No FYM	FYM residues
AB	0	2.60	3.12	3.06	4.51	3.71	3.53
	60	5.78	5.31	5.53	6.61	5.46	5.08
	120	7.77	8.26	5.75	7.31	6.91	6.25
	180	8.33	8.06	4.59	5.73	6.07	6.40
AF	0	2.32	2.48	1.00	1.65	3.38	3.62
	60	4.76	5.65	4.50	3.48	6.55	6.59
	120	7.50	7.80	5.71	4.69	6.30	7.46
	180	8.30	8.67	4.08	5.07	7.02	7.12
Ln3	0	5.21	4.87	4.54	5.11	5.15	5.36
	60	7.29	6.94	6.55	6.39	7.05	6.84
	120	8.53	8.26	6.12	5.93	7.59	7.61
	180	7.52	7.41	5.57	5.08	7.14	6.70
Ln8	0	4.03	6.32	4.70	5.69	6.18	6.17
	60	6.84	7.13	7.11	6.70	6.73	7.70
	120	7.44	8.38	6.49	5.41	6.73	6.76
	180	7.81	7.46	6.44	5.74	6.98	6.09
Lc3	0	5.01	4.99	4.92	3.53	5.18	5.76
	60	7.70	7.86	6.02	6.57	7.18	7.48
	120	8.49	7.94	6.46	5.75	7.70	7.75
	180	7.90	7.39	5.23	6.52	6.40	6.30
Lc8	0	5.17	6.14	5.01	5.58	6.00	6.55
	60	7.41	8.33	6.55	6.30	7.09	8.03
	120	8.81	8.63	5.39	6.04	7.42	6.24
	180	7.99	7.01	6.83	4.73	7.05	7.56

<sup>a</sup> An extra 60 kg N ha<sup>-1</sup> applied to all except N0 subplots in 1963 only.

<sup>b</sup> Residues of 38 t FYM ha<sup>-1</sup> applied every 5th year. Last applied in 1963, 1964, 1965, 1966 and 1967 to

Year and block							
1985		1986		1987		1988	
II		I		III		V	
No FYM	FYM residues	No FYM	FYM residues	No FYM	FYM residues	No FYM	FYM residues
0.93	1.49	2.18	1.76	2.13	2.84	2.30	2.30
4.53	3.93	4.54	3.88	5.42	5.20	3.75	4.47
4.95	4.94	4.97	4.65	6.09	6.04	4.10	4.77
5.58	4.96	4.37	4.67	6.42	5.69	4.26	4.61
2.01	2.21	1.01	1.06	2.26	1.95	1.76	2.27
5.71	5.34	3.61	4.40	4.33	5.22	3.32	3.96
6.16	6.33	4.31	4.00	5.71	6.53	4.07	5.33
5.36	5.75	3.66	4.50	6.62	6.06	4.81	4.47
4.52	5.23	4.02	3.50	4.28	3.84	4.06	3.76
5.82	5.37	5.88	6.26	6.10	5.73	4.79	4.52
4.92	7.52	5.00	5.17	6.64	6.47	4.56	4.51
4.00	4.29	6.08	6.59	5.98	5.62	4.66	4.33
5.65	4.86	4.02	3.25	4.63	4.99	4.13	3.73
6.38	6.55	4.69	3.72	6.42	7.12	4.59	5.21
5.98	5.59	5.58	5.70	7.56	6.49	5.37	4.62
4.90	5.24	4.75	4.27	6.36	5.78	5.36	3.91
4.35	4.77	4.45	4.64	4.93	4.73	3.69	3.88
6.03	5.48	4.06	5.90	6.78	6.40	4.83	4.34
5.16	4.76	5.96	5.79	6.17	6.45	4.85	4.99
4.76	5.28	5.02	4.85	5.26	5.87	4.28	4.10
4.62	4.93	4.40	3.44	5.11	5.34	3.69	4.16
6.26	6.26	5.49	5.92	6.69	6.54	5.20	4.21
6.02	5.66	6.09	5.64	6.68	6.15	4.61	4.04
5.27	5.53	5.28	5.36	6.46	6.50	4.26	4.64

half of the plots in Block IV, II, I, III and V respectively (See Johnston *et al.*, 2022, for details).

1989		1990		1991	
IV		II		I	
No FYM	FYM residues	No FYM	FYM residues	No FYM	FYM residues
1.15	1.59	0.52	0.57	2.80	2.66
3.48	2.80	1.51	2.08	6.09	5.79
3.32	3.08	2.20	2.37	7.14	7.31
2.47	2.84	1.38	1.62	7.44	7.22
1.44	1.72	0.80	1.04	1.89	1.62
3.69	3.73	2.96	2.61	5.90	5.93
3.70	3.57	3.72	3.50	6.73	7.15
3.90	3.83	3.42	3.85	7.60	7.03
2.56	2.28	2.56	2.72	4.54	4.83
3.48	3.33	3.61	4.55	6.51	6.87
4.04	3.63	3.67	3.62	7.15	7.68
4.01	3.53	4.15	4.43	7.42	7.34
2.35	3.04	1.79	2.49	5.08	5.85
3.40	3.45	3.56	3.02	6.84	6.90
3.28	4.00	3.31	3.55	7.00	7.10
3.63	3.60	3.37	3.30	7.12	6.56
2.53	2.45	1.61	1.33	5.02	5.50
3.08	3.21	2.75	3.08	6.72	7.26
3.58	3.56	2.49	3.90	7.70	7.57
3.34	3.73	3.15	3.50	7.51	7.43
2.80	2.60	2.31	2.72	5.63	5.93
3.80	3.20	3.95	4.06	7.22	7.02
3.60	3.36	4.29	4.48	7.60	7.62
3.70	3.25	3.83	4.15	6.98	7.39

**Supplementary Table 3** Woburn Ley-arable. Yields of winter rye grain, t ha<sup>-1</sup> at 85% dry matter

Rotation	Fertiliser N applied kg ha <sup>-1</sup>	1997		1998		1999	
		III		V		IV	
		No FYM	FYM residues <sup>a</sup>	No FYM	FYM residues	No FYM	FYM residues
AB	0	1.67	2.56	4.18	5.25	3.00	3.05
	40	3.54	4.03	6.28	7.88	4.06	4.94
	80	4.73	5.65	7.44	8.10	6.28	7.86
	120	5.71	6.23	6.84	6.59	8.25	8.78
AF	0	0.89	1.39	3.16	4.13	2.76	2.48
	40	2.82	3.42	5.55	5.56	4.74	4.13
	80	4.56	4.46	6.70	6.81	6.13	6.19
	120	4.85	5.32	6.91	6.28	7.74	7.56
Ln3	0	3.46	2.95	6.97	6.87	5.48	5.30
	40	4.94	4.89	8.00	8.82	7.68	7.30
	80	6.29	5.18	7.96	8.74	9.00	9.28
	120	4.87	5.59	6.69	7.37	9.68	9.85
Ln8	0	3.52	3.70	7.32	8.39	5.64	5.85
	40	5.33	5.67	8.84	8.21	8.27	7.21
	80	6.27	6.05	7.21	8.03	9.16	9.45
	120	6.35	6.24	7.04	8.02	8.89	10.42
Lc3	0	3.02	3.53	7.32	6.12	5.52	5.75
	40	5.48	4.89	6.48	6.63	7.71	10.21
	80	5.86	6.37	6.20	7.77	9.17	9.53
	120	6.78	6.58	4.94	5.83	9.76	9.62
Lc8	0	3.87	3.48	7.62	6.42	5.59	5.21
	40	4.68	5.92	7.95	6.69	9.81	8.47
	80	5.88	5.42	7.57	8.17	9.07	9.78
	120	4.89	6.47	7.55	6.39	10.19	9.64

<sup>a</sup> Residues of 38 t FYM ha<sup>-1</sup> applied every 5th year. Last applied in 1963, 1964, 1965, 1966 and 1967 to in Block IV, II, I, III and V respectively (See Johnston et al., 2022, for details).

2000		2001	
II		I	
No FYM	FYM residues	No FYM	FYM residues
2.98	3.70	2.77	2.72
5.78	6.20	3.58	3.71
7.86	7.82	4.68	4.01
8.59	8.86	4.81	4.53
4.78	2.93	0.99	1.32
7.27	6.00	2.44	2.52
7.55	7.34	2.44	3.33
8.80	7.69	4.07	4.03
6.90	6.07	3.30	3.17
8.52	7.59	4.19	4.13
8.97	8.78	4.96	5.00
8.71	8.36	5.33	4.97
6.88	5.27	3.57	3.34
8.94	8.20	4.39	4.03
9.81	9.17	4.86	5.57
9.50	9.23	4.75	5.97
4.50	6.80	3.72	3.44
7.91	7.34	3.80	3.82
9.28	9.03	4.72	4.18
9.21	9.54	5.53	3.44
6.65	6.01	2.27	2.73
8.37	7.92	4.25	3.66
8.22	8.17	4.79	4.53
7.42	8.29	5.61	4.76

half of the plots