ROTHAMSTED RESEARCH

Yields of the Field Experiments 1997

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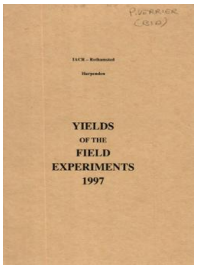

97/R/BK/1 Broadbalk - W. Wheat, W. Oats, Forage Maize

Rothamsted Research

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97/R/BK/1

BROADBALK

Object: To study the effects of organic and inorganic manures on continuous w. wheat. From 1968 two three-year rotations were included: potatoes, beans, w. wheat and fallow, w. wheat, w. wheat. In 1979 the first rotation was changed to fallow, potatoes, w. wheat. In 1980 the second rotation reverted to continuous w. wheat. Since 1985 part of the second rotation has been added to the first to extend the rotation to fallow, potatoes, w. wheat, w. wheat, w. wheat, in 1996 the fallow was replaced by w.oats and potatoes replaced by maize in 1997.

The 154th year, w. wheat, w.oats and forage maize.

For previous years see 'Details' 1967 and 1973, Station Report for 1966, pp. 229-231, Station Report for 1978, Part 2, Station Report for 1982, Part 2, pp. 5-44 and 74-96/R/BK/1.

Areas harvested:

	Section	
Wheat:	0	0.00351
	1	0.00645
	4,5,6 and 7	0.00533
	8 and 9	0.00561
Oats:	2	0.00533
Maize:	3	0.00162

Treatments:

Whole plots

PLOT		Fertilizers and organic manures:-		
	Plot	Treatments until 1967	Treatments from 1968	Treatments from 1985
01DN4PK	01	-	D N2 P K	D N4 P K
21DN2	21	D	D N2	D N2
22D	22	D	D	D
030	03	None	None	None
05F	05	P K Na Mg	P K (Na) Mg	PK Mg
06N1F	06	N1 P K Na Mg	N1 P K (Na) Mg	N1 P K Mg
07N2F	07	N2 P K Na Mg	N2 P K (Na) Mg	N2 P K Mg
08N3F	08	N3 P K Na Mg	N3 P K (Na) Mg	N3 P K Mg
09N4F	09	N*1 P K Na Mg	N4 P K (Na) Mg	N4 P K Mg
10N2	10	N2	N2	N2
11N2P	11	N2 P	N2 P	N2 P
12N2PNA	12	N2 P Na	N2 P Na	N2 P Na
13N2PK	13	N2 P K	N2 P K	N2 P K
14N2PKMG	14	N2 P Mg	N2 P K Mg	N2 P K Mg
15N5F	15	N2 P K Na Mg	N3 P K (Na) Mg	N5 P K Mg
16N6F	16	N*2 P K Na Mg	N2 P K (Na) Mg	N6 P K Mg
17N0+3FH	17	N2(A)	N2 1/2(P K (Na) Mg)	N0+3 1/2(PK Mg)+
18N1+3FH	18	P K Na Mg(A)	N2 1/2(P K (Na) Mg)	N1+3 1/2(PK Mg)+
19(C)	19	C	C	(C) (since 1989)
20N2KMG	20	N2 K Na Mg	N2 K (Na) Mg	N2 K Mg

(A) Alternating

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\+ This change since 1980. Treatments shown are those to w. wheat; autumn N alternates. Maize received N3 1/2 (PK Mg) on both plots 17 and 18.

W. oats; Nitrogen and dung were not applied.

N1,N2,N3,N4,N5,N6:	48, 97, 144, 192, 240, 288 kg N as sulphate of ammonia until 1977, except N* which was nitrate of soda. All as 'Nitro-Chalk' in spring from 1978 to 1985, as 34.5% N since 1986.
N0+3; N1+3:	None in autumn + 144 kg N in spring; 48 kg N in autumn + 144 kg N in spring
P:	35 kg P as triple superphosphate in 1974 and since 1988, single superphosphate in other years
K:	90 kg K as sulphate of potash
Na:	55 kg Na as sulphate of soda
(Na):	16 kg Na as sulphate of soda until 1973
Mg:	30 kg Mg annually to Plot 14, 35 kg Mg every third year to other plots since 1974. All as kieserite since 1974, previously as sulphate of magnesia annually
D:	Farmyard manure at 35 t
(C):	Castor meal to supply 97 kg N until 1988, none since
F:	P K (Na) Mg H: Half rate

Strips of sub-plots: Until 1977 wheat alone was grown on the experiment, with some bare fallowing. From 1978, ten strips of sub-plots (sections) were started with the following cropping:-

SECTION	1/W31	9/W39	0/W46	8/W3	6/W20	5/W1	3/M	7/W3	4/W2	2/O
Section	1	9	0*	8+	6**	5	3	7	4	2
Year										
1968	W	W	W	W	F	W	W	P	W	BE
1969	W	W	W	W	W	F	W	BE	P	W
1970	W	W	W	W	W	W	F	W	BE	P
1971	W	W	W	W	F	W	W	P	W	BE
1972	W	W	W	W	W	F	W	BE	P	W
1973	W	W	W	W	W	W	F	W	BE	P
1974	W	W	W	W	F	W	W	P	W	BE
1975	W	W	W	W	W	F	W	BE	P	W
1976	W	W	W	W	W	W	F	W	BE	P
1977	W	W	W	W	F	W	W	P	W	BE
1978	W	W	W	W	W	F	W	BE	P	W
1979	W	W	W	W	W	W	F	W	P	F
1980	W	W	W	W	W	W	W	F	W	P
1981	W	W	W	F	W	W	W	P	F	W
1982	W	W	W	W	W	W	W	W	P	F
1983	W	W	W	W	W	W	W	F	W	P
1984	W	W	W	W	W	W	W	P	F	W
1985	W	W	W	W	W	F	W	W	P	W
1986	W	W	W	W	W	P	F	W	W	W
1987	W	W	W	W	W	W	P	W	W	F
1988	W	W	W	F	W	W	W	F	W	P

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SECTION	1/W31	9/W39	0/W46	8/W3	6/W20	5/W1	3/M	7/W3	4/W2	2/O
Section	1	9	0*	8+	6**	5	3	7	4	2
Year										
1989	W	W	W	W	W	W	W	P	F	W
1990	W	W	W	W	W	F	W	W	P	W
1991	W	W	W	W	W	P	F	W	W	W
1992	W	W	W	W	W	W	P	W	W	F
1993	W	W	W	W	W	W	W	F	W	P
1994	W	W	W	F	W	W	W	P	F	W
1995	W	W	W	W	W	F	W	W	P	W
1996	W	W	W	W	W	P	O	W	W	W
1997	W	W	W	W	W	W	M	W	W	O

W = w. wheat, O = w. oats, P = potatoes, BE = s. beans, F = fallow, M = forage maize

* Straw incorporated since autumn 1986. ** No sprays except weedkillers since 1985. + No weedkillers.

NOTES: (1) For a fuller record of treatments see 'Details' etc.
(2) From autumn 1975 to autumn 1986, chalk was applied at 2.9 t each autumn to all plots in sets of Sections on a three-year cycle. Year 1: Sections 1,2,3. Year 2: Sections 6,7,8,9. Year 3: Sections 0,4,5. From autumn 1988 until autumn 1992 a five-year cycle was used. Year 1: Sections 1,3. Year 2: Sections 2,8. Year 3: Sections 7,9. Year 4: Sections 4,6. Year 5: Sections 0,5. None applied since autumn 1991.

Experimental diary:

All sections:

25-Sep-96 : **T** : PK Na and Mg applied.
28-Sep-96 : B : Ploughed and furrow pressed.
14-Oct-96 : B : Rotary harrowed.

Cropped sections:

W. wheat:

20-Aug-96 : **T** : Straw chopped (section 0 only), straw baled (sections 1, 2, 3, 4, 6, 7, 8 and 9).
26-Sep-96 : **T** : Autumn N treatment applied.
27-Sep-96 : **T** : Farmyard manure applied.
15-Oct-96 : **T** : Rotary harrowed, Hereward, dressed Beret Gold and Fonophos Seed Treatment at 380 seeds per m^2.
02-Apr-97 : **T** : Topik at 125 ml with Sprayprover at 1.0 l in 200 l (except section 8).
10-Apr-97 : **T** : MSS Optica at 2.5 l in 300 l (except section 8).
: **T** : Barclay Holdup at 2.3 l in 300 l (except section 6).
11-Apr-97 : **T** : Spring N treatments applied.
01-May-97 : **T** : Barclay Eyetak at 0.9 l in 200 l (except section 6).
29-May-97 : **T** : Starane 2 at 0.5 l in 300 l (except section 8).
30-May-97 : **T** : Folicur at 0.5 l with Pointer at 0.5 l in 300 l (except section 6).
09-Jul-97 : **T** : Hand rogued wild oats.
01-Sep-97 : **T** : Combine harvested.

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Experimental diary:

W. oats:

20-Aug-96 : T : Wheat straw baled.
16-Oct-96 : T : Rotary harrowed, Image, dressed Anchor, drilled at 350 seeds per m^2.
17-Oct-96 : T : Tribunil at 2.25 kg in 200 l.
22-May-97 : T : Radar at 0.5 l with Stefes CCC 700 at 2.3 l in 300 l.
20-Aug-97 : T : Combine harvested.

Forage Maize:

20-Aug-96 : T : Oat straw baled.
27-Sep-96 : T : Farmyard manure applied.
16-Apr-97 : T : Scythe LC at 3.0 l with Vassgro Non-ionic at 200 ml in 200 l.
23-Apr-97 : T : Spring N treatments applied, heavy spring-tine cultivated, rotary harrowed, Hudson, dressed Mesurol, drilled at 11 seeds per m^2.
09-Jun-97 : T : Barclay Mutiny at 1.5 l in 300 l.
17-Sep-97 : T : Hand harvested.

NOTE: Samples of wheat grain and straw from sections 1, 5, 6 and 9, samples of oat grain and straw and whole crop maize were taken for chemical analysis. Unground grain and straw and maize samples from selected treatments were archived.

W. WHEAT

GRAIN TONNES/HECTARE

***** Tables of means *****

SECTION / PLOT	5/W1	4/W2	7/W3	8/W3	6/W20	1/W31	9/W39	0/W46
01DN4PK	9.18	9.56	9.27	*	8.21	*	*	*
21DN2	9.57	8.38	8.04	5.67	7.44	7.88	7.82	6.70
22D	9.44	5.65	5.14	4.18	5.73	5.61	4.47	4.30
030	4.52	0.71	0.63	1.31	0.91	1.03	0.77	1.06
05F	2.59	0.67	0.68	2.17	0.99	1.01	0.91	0.96
06N1F	6.17	3.05	2.65	2.47	3.07	2.95	3.11	2.77
07N2F	8.62	5.76	4.95	3.77	5.11	5.63	5.17	5.17
08N3F	9.56	6.89	6.76	5.00	6.74	6.96	6.59	6.58
09N4F	9.61	7.89	7.72	6.02	6.91	7.12	7.37	7.61
10N2	7.82	4.19	2.56	2.09	2.25	2.59	2.54	2.68
11N2P	7.43	5.20	5.22	1.53	2.54	3.07	2.66	4.41
12N2PNA	7.77	5.49	5.20	3.32	4.33	3.71	3.61	5.06
13N2PK	8.46	5.59	5.30	3.96	5.07	5.29	5.62	5.34
14N2PKMG	7.99	5.39	5.25	4.19	5.39	5.31	5.81	5.34
15N5F	9.40	8.87	8.98	3.79	8.30	8.47	7.83	8.12
16N6F	9.23	8.91	8.97	3.97	8.03	8.46	8.83	8.28
17N0+3FH	9.12	8.06	7.65	4.64	7.77	7.70	7.31	7.67
18N1+3FH	9.41	8.06	7.76	5.13	8.02	7.61	7.33	7.68
19(C)	4.68	0.99	0.58	2.09	1.12	1.93	1.29	1.67
20N2KMG	*	*	*	*	*	1.87	*	2.10

GRAIN MEAN DM% 83.2

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STRAW TONNES/HECTARE

***** Tables of means *****

SECTION PLOT	5/W1	6/W20	1/W31	9/W39
01DN4PK	3.88	*	*	*
21DN2	4.40	3.95	4.84	3.07
22D	5.33	3.47	3.53	2.67
030	2.07	0.60	0.49	0.14
05F	1.54	0.57	0.69	0.37
06N1F	3.17	1.36	1.33	1.31
07N2F	3.81	1.89	2.26	1.73
08N3F	4.08	2.23	2.86	1.87
09N4F	3.78	2.29	2.72	2.28
10N2	2.91	*	1.16	*
11N2P	2.42	*	1.00	*
12N2PNA	2.91	*	1.00	*
13N2PK	3.13	*	1.87	*
14N2PKMG	3.30	*	1.63	*
15N5F	4.37	2.89	3.22	2.44
16N6F	4.19	2.85	3.80	3.16
17N0+3FH	4.29	*	3.09	*
18N1+3FH	4.21	*	2.82	*
19(C)	2.32	*	0.82	*
20N2KMG	*	*	1.08	*

STRAW MEAN DM% 87.3

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GRAIN TONNES/HECTARE

***** Tables of means *****

PLOT	GRAIN	STRAW
01DN4PK	7.53	6.18
21DN2	7.14	4.76
22D	7.24	5.12
030	1.32	0.43
05F	1.80	0.74
06N1F	1.81	0.65
07N2F	2.23	0.94
08N3F	2.73	1.19
09N4F	2.79	1.37
10N2	2.24	1.04
11N2P	2.44	0.98
12N2PNA	2.34	0.84
13N2PK	1.97	0.93
14N2PKMG	1.86	0.71
15N5F	5.14	2.94
16N6F	6.71	3.62
17N0+3FH	3.70	2.19
18N1+3FH	2.18	0.89
19(C)	1.85	0.84

GRAIN MEAN DM% 86.8 STRAW MEAN DM% 77.5

NOTE: Dung and nitrogen treatments are residual from previous wheat.

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97/R/BK/1 MAIZE

WHOLE CROP (100% DM) TONNES/HECTARE

***** Tables of means *****

PLOT	WHOLE CROP
01DN4PK	16.36
21DN2	17.45
22D	17.53
030	3.64
05F	4.79
06N1F	11.85
07N2F	14.86
08N3F	18.62
09N4F	18.50
10N2	5.77
11N2P	6.46
12N2PNA	8.73
13N2PK	15.52
14N2PKMG	14.97
15N5F	15.85
16N6F	18.72
17N0+3FH	15.81
18N1+3FH	16.35
19(C)	5.44

CROP MEAN DM% 36.1

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