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# Yields of the Field Experiments 1983

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## 83/S/RN/1 Rotation I - Grass, W. Beans, W. Wheat

### Rothamsted Research

Rothamsted Research (1984) *83/S/RN/1 Rotation I - Grass, W. Beans, W. Wheat* ; Yields Of The Field Experiments 1983, pp 34 - 41 - DOI: <https://doi.org/10.23637/ERADOC-1-44>

83/S/RN/1

ROTATION I

Object: To compare nutrient cycles, uptakes of nutrients and responses to fresh P and K. To obtain an estimate of the rate of release of nutrients, particularly K, from Saxmundham soil - Saxmundham.

Sponsor: A.E. Johnston.

The 84th year, grass, w. wheat, w. beans, s. barley.

For previous years see 'Details' 1967 and 1973, and 74-82/S/RN/1.

Whole plot dimensions (original treatments): 5.49 x 40.2.

Treatments: From 1899 to 1969 the experiment followed a four-course rotation of w. wheat, roots, s. barley, legumes. Each phase of the rotation was present each year on a separate block. From 1966 each plot was divided, a small area at the south end being continued under the original treatment until 1979 (OLDTREAT), modified treatments (NEWTREAT) being applied on the larger sub-plots (see below).

In 1970 the rotation was stopped and each pair of blocks was divided for lucerne and grass (the OLDTREAT sub-plots form a part of the Grass area). In 1977 lucerne was ploughed on one pair of blocks to start an arable rotation and in 1978 lucerne on the other blocks was replaced by a grass/clover mixture. The grass/clover mixture was ploughed in 1979 for a test of subsoiling. Part of the grass area on two of the blocks was ploughed in autumn 1980 and added to the arable rotation area; the remainder of the grass on these two blocks was destroyed after the first cut in 1982; part of the arable rotation area was added to these two blocks for a new test on the effects of soil K depletion. Treatments to the remaining grass in 1983 were:

TREATMENT 1899-1965	OLDTREAT Grass 1966-79	NEWTREAT Grass 1966-83
	MANURE (D)	MANURE (D)N
D	(D)	(D)N
B	B	BN
N	N	(N)P2N
P	P	(P)P1N
K	K	(K)P2KN
-	-	(-)P2N
PK	PK	(PK)P1KN
NK	NK	(NK)P2KN
NP	NP	(NP)P1N
NPK	NPK	(NPK)P1KN

- D: Farmyard manure at 15 tonnes  
 (D): Farmyard manure at 30 tonnes (1966-1969 15 tonnes on OLDTREAT),  
 60 tonnes in autumn 1969, none since  
 B: Bone meal at 0.5 tonnes  
 N: 1899-1965 - 38 kg N as nitrate of soda. Since 1970 - 100 kg N  
 (38 kg N on OLDTREAT) per cut as ammonium nitrate ('Nitro-Chalk'  
 until 1982)  
 P: 1899-1965 40 kg P205 as single superphosphate. Since 1966  
 50 kg P205 as triple superphosphate

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P1,P2: 50, 100 kg P2O5 as triple superphosphate  
K: 1899-1965 63 kg K2O as muriate of potash. Since 1966 - 126 kg K2O  
(75 kg K2O on OLDTREAT)

- NOTES: (1) For a fuller record of treatments see 'Details' etc.  
(2) On OLDTREAT grass, clover appeared naturally on some plots in 1975. To unify the plots, white clover was sown on all at 33 kg.  
(3) From 1980 treatments have not been applied to OLDTREAT grass and yields have not been taken.

The pair of blocks in arable crops from 1977 were sown to w. wheat in 1983. Yields were not taken.

MANURE                      Manures applied 1899-1965 and 1966-83:

(D)P2N  
BN  
(N)P2N  
(P)P1N  
(K)P2KN  
(-)P2N  
(PK)P1KN  
(NK)P2KN  
(NP)P1N  
(NPK)P1KN

N: 40 kg N as 'Nitro-Chalk' at drilling; 160 kg N as ammonium nitrate in spring. Other symbols as above.

The pair of blocks testing subsoiling were sown to s. barley and tested all combinations of:

Whole plots

1. MANURE (as for w. wheat above but with basal N at 30 kg N as ammonium nitrate at sowing) and:

2. TREATMNT      Cultivations etc in May, 1979 only:

CNVNTIAL      Conventional, mouldboard ploughed  
SUBDUG      Subsoil dug by Wye double digger  
SUBDUG+F      Subsoil dug by Wye double digger  
                 incorporating P at 374 kg and K at 712 kg (as 0:20:20)  
                 into the subsoil at the time of working

Sub plots

3. N                      Nitrogen fertilizer (kg N) as 'Nitro-Chalk'  
                                 in addition to the 30 kg N at sowing:

30  
60  
90  
120

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The new test on the effects of soil K depletion included w. beans on the area after grass 1982 and w. wheat on the area after arable. W. wheat tested all combinations of:-

Whole plots

1. MANURE (as for w. wheat on arable crop test blocks above)

Sub plots

2. N Nitrogen fertilizer (kg N) as 'Nitro-Chalk' in spring in addition to 40 kg N at sowing:-

120  
160  
200  
240

W. beans tested:-

Whole plots

1. MANURE (as for w. wheat above but without basal N)

Standard applications:

- W. wheat, on arable crops from 1977, and new soil K depletion test:  
Weedkillers: Mecoprop, bromoxynil and ioxynil (as 'Brittox' at 3.5 l) in 220 l with isoproturon at 2.5 kg and with the permethrin.  
Fungicides: Carbendazim at 0.15 kg, maneb at 1.6 kg and tridemorph at 0.37 kg with captafol at 1.0 kg in 220 l applied with the pirimicarb. Propiconazole at 0.12 kg in 220 l (to new soil K depletion test only). Insecticides: Permethrin at 0.05 kg. Pirimicarb at 0.14 kg.
- W. beans: Weedkiller: Simazine at 1.1 l in 220 l. Fungicide: Benomyl at 0.28 kg in 220 l, on two occasions.
- S. barley: Weedkillers: Mecoprop, bromoxynil and ioxynil (as 'Brittox' at 3.5 l) in 220 l. Fungicides: Carbendazim at 0.15 kg, maneb at 1.6 kg and tridemorph at 0.37 kg applied in 220 l with the insecticide. Insecticide: Pirimicarb at 0.14 kg.

- Seed: W. wheat: Norman, sown at 400 seeds per m<sup>2</sup>.  
W. beans: Throws MS, sown at 250 kg.  
S. barley: Triumph, seed dressed with ethirimol, sown at 180 kg.

Cultivations, etc.:-

- W. wheat on arable crops from 1977 and on new soil K depletion test:  
P and K treatments applied: 3 Sept, 1982. Ploughed: 15 Sept. Power harrowed, seedbed N applied, seed sown: 29 Sept. 'Brittox', isoproturon and permethrin applied: 28 Oct. Treatment N applied (to new soil K depletion test only): 27 Apr, 1983. Basal N applied (to arable crops for 1977 only): 28 Apr. Bonemeal applied: 28 Apr. Carbendazim, maneb, tridemorph, captafol and pirimicarb applied: 30 June. Propiconazole applied to new soil K depletion test only: 13 July. Combine harvested: 9 Aug.
- W. beans: P and K treatments applied: 3 Sept, 1982. Ploughed: 15 Sept. Power harrowed, seed sown: 28 Oct. Weedkiller applied: 29 Oct. Bonemeal applied: 28 Apr, 1983. Fungicide applied: 4 May, 30 June. Combine harvested: 26 Aug.

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S. barley: P and K treatments applied: 3 Sept, 1982. Ploughed: 19 Oct.  
 Power harrowed, seedbed N applied, seed sown: 10 Mar, 1983.  
 Treatment N and bonemeal applied: 28 Apr. Weedkiller applied: 4 May.  
 Fungicides and insecticide applied: 30 June. Combine harvested:  
 10 Aug.  
 Grass section: P, K and bonemeal treatments applied: 23 Feb, 1983.  
 N applied: 10 Mar. Cut: 30 June. N applied: 13 July. Cut: 15 Nov.

GRASS

DRY MATTER TONNES/HECTARE

\*\*\*\*\* TABLES OF MEANS \*\*\*\*\*

	1ST CUT(30/6/83)	2ND CUT(15/11/83)	TOTAL OF 2 CUTS
MANURE			
(D)N	5.40	0.85	6.25
BN	5.23	0.68	5.91
(N)P2N	5.31	0.57	5.89
(P)P1N	4.97	0.47	5.44
(K)P2KN	5.84	0.86	6.70
(-)P2N	5.94	1.07	7.02
(PK)P1KN	6.12	1.21	7.33
(NK)P2KN	6.46	1.52	7.98
(NP)P1N	5.57	1.08	6.65
(NPK)P1KN	5.91	1.30	7.20
MEAN	5.68	0.96	6.64
MEAN DM%	29.3	42.0	35.7

PLOT AREA HARVESTED 0.00095

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W.WHEAT

GRAIN TONNES/HECTARE

\*\*\*\*\* TABLES OF MEANS \*\*\*\*\*

	N	120	160	200	240	MEAN
MANURE						
(D)P2N		9.76	9.95	8.49	8.87	9.27
BN		8.94	8.38	8.78	7.72	8.46
(N)P2N		7.81	8.24	8.95	8.12	8.28
(P)P1N		8.95	8.27	7.71	9.43	8.59
(K)P2KN		9.85	11.40	10.00	9.75	10.25
(-)P2N		9.48	9.02	8.81	9.82	9.28
(PK)P1KN		+	9.98*	10.08*	+	
(NK)P2KN		11.00	10.13	10.31	9.41	10.21
(NP)P1N		9.19	9.06	10.12	8.93	9.32
(NPK)P1KN		10.27*	+	+	10.00*	

\* THESE PLOTS WERE DUPLICATED

+ TREATMENT COMBINATION MISSING

GRAIN MEAN DM% 82.0

PLOT AREA HARVESTED 0.00075

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W.BEANS

GRAIN TONNES/HECTARE

\*\*\*\*\* TABLES OF MEANS \*\*\*\*\*

MANURE	
(D)P2	3.08
B	2.47
(N)P2	2.39
(P)P1	3.01
K)P2K	4.16
(-)P2	3.18
PK)P1K	4.63
(NK)P2K	4.40
(NP)P1	3.07
(NPK)P1K	4.67
MEAN	3.51

\*\*\*\*\* STANDARD ERRORS OF DIFFERENCES OF MEANS \*\*\*\*\*

TABLE	MANURE
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SED	0.215

\*\*\*\*\* STRATUM STANDARD ERRORS AND COEFFICIENTS OF VARIATION \*\*\*\*\*

STRATUM	DF	SE	CV%
BLOCK.WP	9	0.215	6.1

GRAIN MEAN DM% 86.2

PLOT AREA HARVESTED 0.00556

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S. BARLEY

GRAIN TONNES/HECTARE

\*\*\*\*\* TABLES OF MEANS \*\*\*\*\*

TREATMNT	CNVNTIAL	SUBDUG	SUBDUG+F	MEAN	
MANURE					
(D)P2N	5.11	5.76	5.72	5.53	
BN	4.14	4.57	4.60	4.44	
(N)P2N	4.48	4.67	4.58	4.58	
(P)P1N	3.96	4.05	4.37	4.13	
(K)P2KN	4.83	4.44	4.49	4.59	
(-)P2N	4.88	4.75	4.66	4.76	
(PK)P1KN	4.46	4.76	4.57	4.59	
(NK)P2KN	4.58	4.76	5.05	4.79	
(NP)P1N	3.86	4.05	4.35	4.09	
(NPK)P1KN	4.30	4.47	4.51	4.43	
MEAN	4.46	4.63	4.69	4.59	
N	30	60	90	120	MEAN
MANURE					
(D)P2N	3.47	5.67	5.93	7.05	5.53
BN	2.73	4.63	4.83	5.55	4.44
(N)P2N	2.86	3.86	5.57	6.01	4.58
(P)P1N	2.37	3.70	4.74	5.70	4.13
(K)P2KN	2.73	4.23	5.40	5.99	4.59
(-)P2N	2.80	4.37	5.46	6.41	4.76
(PK)P1KN	2.33	4.24	5.56	6.24	4.59
(NK)P2KN	2.82	4.38	5.62	6.36	4.79
(NP)P1N	2.34	3.65	4.93	5.43	4.09
(NPK)P1KN	2.77	3.79	5.13	6.01	4.43
MEAN	2.72	4.25	5.32	6.07	4.59
N	30	60	90	120	MEAN
TREATMNT					
CNVNTIAL	2.59	4.16	5.31	5.78	4.46
SUBDUG	2.93	4.10	5.30	6.18	4.63
SUBDUG+F	2.65	4.50	5.35	6.26	4.69
MEAN	2.72	4.25	5.32	6.07	4.59



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S. BARLEY

GRAIN TONNES/HECTARE

\*\*\*\*\* TABLES OF MEANS \*\*\*\*\*

		N	30	60	90	120
MANURE	TREATMNT					
(D)P2N	CNVNTIAL		3.19	5.00	5.58	6.66
	SUBDUG		3.46	6.16	6.37	7.06
	SUBDUG+F		3.75	5.85	5.83	7.42
BN	CNVNTIAL		2.64	4.30	4.56	5.05
	SUBDUG		3.91	4.36	4.25	5.76
	SUBDUG+F		1.64	5.23	5.68	5.85
(N)P2N	CNVNTIAL		3.02	3.92	5.52	5.45
	SUBDUG		3.46	3.42	5.49	6.32
	SUBDUG+F		2.11	4.24	5.71	6.27
(P)P1N	CNVNTIAL		2.32	3.44	4.84	5.25
	SUBDUG		2.53	3.51	4.62	5.55
	SUBDUG+F		2.28	4.14	4.77	6.30
(K)P2KN	CNVNTIAL		3.16	4.59	5.43	6.15
	SUBDUG		2.01	3.96	5.99	5.78
	SUBDUG+F		3.01	4.13	4.79	6.02
(-)P2N	CNVNTIAL		2.77	4.50	6.19	6.06
	SUBDUG		2.79	4.63	5.17	6.43
	SUBDUG+F		2.85	3.98	5.03	6.75
(PK)P1KN	CNVNTIAL		1.74	4.37	5.66	6.04
	SUBDUG		2.75	3.95	5.99	6.34
	SUBDUG+F		2.49	4.41	5.03	6.34
(NK)P2KN	CNVNTIAL		2.26	4.24	5.84	5.96
	SUBDUG		2.90	4.06	5.63	6.45
	SUBDUG+F		3.30	4.85	5.39	6.65
(NP)P1N	CNVNTIAL		1.98	3.62	4.85	5.00
	SUBDUG		2.51	3.21	4.69	5.80
	SUBDUG+F		2.52	4.13	5.25	5.49
(NPK)P1KN	CNVNTIAL		2.83	3.58	4.58	6.20
	SUBDUG		2.96	3.78	4.82	6.31
	SUBDUG+F		2.51	4.01	6.01	5.51

GRAIN MEAN DM% 84.6

SUB PLOT AREA HARVESTED 0.00081