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## Yields of the Field Experiments 1986

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### 86/R/RN/17 Rates of P and K to the Subsoil - Potatoes, S. Barley, S. Beans, W. Wheat

#### Rothamsted Research

Rothamsted Research (1987) *86/R/RN/17 Rates of P and K to the Subsoil - Potatoes, S. Barley, S. Beans, W. Wheat* ; Yields Of The Field Experiments 1986, pp 82 - 89 - DOI:

<https://doi.org/10.23637/ERADOC-1-36>

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RATES OF P AND K TO THE SUBSOIL

Object: To study the effects of a range of rates and frequencies of application of P and K to the subsoil, singly and together, on the yields and nutrient uptakes of a rotation of crops - Meadow.

Sponsors: J. McEwen, A.E. Johnston.

The sixth year, potatoes, s. barley, s. beans, w. wheat.

For previous years see 81-85/R/RN/17.

Design: 4 series (for crops) each of 40 plots.

Whole plot dimensions: 3.0 x 14.0.

Treatments to each series:

TREATMNT Extra P and K and primary cultivation tool in autumn 1980 only, except on A plots, treatments repeated annually, and F plots treatments repeated four yearly:

	P205(kg)	K20(kg)	Tool	
- - -	0	0	Plough	(duplicated)
P6 K6 T	1000	500 to topsoil	"	( " )
- - S	0	0	Wye double-digger	(triplicated)
- - SA	0	0	" " "	(duplicated)
- - SF	0	0	" " "	
P2 - SA	63	0 to subsoil	" " "	
P3 - SF	125	0 " "	" " "	
P4 - S	250	0 " "	" " "	
P5 - S	500	0 " "	" " "	
P5 - SF	500	0 " "	" " "	
P6 - S	1000	0 " "	" " "	
- K2 SA	0	31 " "	" " "	
- K3 SF	0	63 " "	" " "	
- K4 S	0	125 " "	" " "	
- K5 S	0	250 " "	" " "	
- K5 SF	0	250 " "	" " "	
- K6 S	0	350 " "	" " "	
P1 K1 SA	31	16 " "	" " "	
P1 K3 SA	31	63 " "	" " "	
P2 K2 SA	63	31 " "	" " "	
P3 K1 SA	125	16 " "	" " "	
P3 K3 SA	125	63 " "	" " "	
P3 K4 SF	125	125 " "	" " "	
P4 K3 SF	250	63 " "	" " "	
P4 K4 S	250	125 " "	" " "	
P4 K5 S	250	250 " "	" " "	
P4 K5 SF	250	250 " "	" " "	
P4 K6 S	250	350 " "	" " "	
P5 K4 S	500	125 " "	" " "	
P5 K4 SF	500	125 " "	" " "	
P5 K5 S	500	250 " "	" " "	
P5 K6 S	500	350 " "	" " "	
P6 K4 S	1000	125 " "	" " "	
P6 K5 S	1000	250 " "	" " "	
P6 K6 S	1000	350 " "	" " "	

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- NOTES: (1) Subsoiling was done with the Wye double-digger which turns a furrow with a conventional plough share, to a depth of 23 cm, and at the same time rotary cultivates the bottom of the adjacent furrow to a further depth of 15 cm. When applying P and K this was distributed ahead of the rotary cultivator.
- (2) The topsoil PK dressing was equally divided before and after ploughing.
- (3) All plots were conventionally ploughed each autumn unless the Wye double-digging treatment was due.
- (4) The rate of 350 kg K20 applied was in error for 500 kg K20.

Standard applications:

- Potatoes: Manures: (10:10:15+4.5 Mg) at 1960 kg. Weedkillers: Paraquat at 0.60 kg ion in 200 l. Linuron at 1.3 kg in 500 l. Fungicide: Mancozeb at 1.4 kg in 200 l on four occasions, applied with the pirimicarb on the third and fourth. Fentin hydroxide at 0.28 kg in 200 l on two occasions, with the pirimicarb on the first. Insecticide: Pirimicarb at 0.14 kg on three occasions with the fungicides. Desiccant: Diquat at 0.60 kg ion in 200 l.
- S. barley: Manures: (20:10:10) at 630 kg. Weedkillers: Clopyralid at 0.07 kg, bromoxynil octanoate at 0.34 kg and mecoprop at 2.5 kg in 200 l applied with the tridemorph. Fungicides: Tridemorph at 0.52 kg. Propiconazole at 0.12 kg in 200 l. Desiccant: Glyphosate at 1.4 kg in 200 l.
- S. beans: Weedkillers: Paraquat at 0.60 kg ion in 200 l. Simazine at 1.2 kg with paraquat at 0.50 kg ion in 200 l. Insecticides: Phorate at 4.5 kg. Pirimicarb at 0.14 kg in 200 l. Desiccant: Diquat at 0.60 kg ion with a wetting agent ('Agral' at 0.075 l) in 500 l.
- W. wheat: Manures: (0:18:36) at 350 kg. 'Nitram' at 520 kg. Weedkillers: Clopyralid at 0.07 kg, bromoxynil octanoate at 0.34 kg, mecoprop at 2.5 kg and isoproturon at 2.1 kg in 200 l. Fungicide: Propiconazole at 0.12 kg in 200 l. Desiccant: Glyphosate at 1.4 kg in 200 l.

- Seed: Potatoes: Pentland Crown.  
S. barley: Klaxon, sown at 160 kg.  
S. beans: Minden, sown at 300 kg.  
W. wheat: Avalon, sown at 190 kg.

Cultivations, etc.:-

- All crops: Treatments applied by double-digger: 4 Nov, 1985 and 5 Nov. Ploughed: 6 Nov. Heavy spring-tine cultivated: 7 Nov, 8 Nov.
- Potatoes: Paraquat applied: 23 Sept, 1985. NPK Mg applied: 12 May, 1986. Rotary harrowed, potatoes planted: 13 May. Rotary ridged: 19 May. Linuron applied: 30 May. Mancozeb applied: 30 June, 14 July. Mancozeb with pirimicarb applied: 28 July, 12 Aug. Fentin hydroxide with pirimicarb applied: 29 Aug. Fentin hydroxide applied: 11 Sept. Haulm mechanically destroyed: 19 Sept. Desiccant applied: 27 Sept. Lifted: 15 Oct.
- S. barley: NPK applied, spring-tine cultivated, rotary harrowed, seed sown: 17 Mar, 1986. Weedkillers with tridemorph applied: 16 May. Propiconazole applied: 25 June. Desiccant applied: 12 Aug. Combine harvested: 29 Aug.

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- S. beans: Paraquat alone applied: 23 Sept, 1985. Phorate applied, spring-tine cultivated, rotary harrowed, seed sown: 11 Apr, 1986. Simazine with paraquat applied: 25 Apr. Pirimicarb applied: 16 July. Desiccant with wetting agent applied: 17 Sept. Combine harvested: 23 Sept.
- W. wheat: PK applied, rotary harrowed, seed sown: 8 Nov, 1985. N applied: 24 Apr, 1986. Weedkillers applied: 30 Apr. Fungicide applied: 25 June. Desiccant applied: 12 Aug. Combine harvested: 30 Aug.



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SERIES IV POTATOES

TOTAL TUBERS TONNES/HECTARE

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

TREATMNT	
- - -	46.0
P6 K6 T	40.6
- - S	40.9
- - SA	44.2
- - SF	45.9
P2 - SA	48.7
P3 - SF	46.2
P4 - S	45.6
P5 - S	49.4
P5 - SF	47.4
P6 - S	44.2
- K2 SA	46.2
- K3 SF	48.3
- K4 S	46.9
- K5 S	43.5
- K5 SF	45.2
- K6 S	46.2
P1 K1 SA	43.1
P1 K3 SA	43.8
P2 K2 SA	45.0
P3 K1 SA	45.6
P3 K3 SA	43.6
P3 K4 SF	50.3
P4 K3 SF	39.7
P4 K4 S	39.5
P4 K5 S	47.2
P4 K5 SF	47.7
P4 K6 S	44.3
P5 K4 S	39.6
P5 K4 SF	45.0
P5 K5 S	37.4
P5 K6 S	41.8
P6 K4 S	43.2
P6 K5 S	39.3
P6 K6 S	47.5
MEAN	44.3

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

TABLE	TREATMNT
-----	-----
SED	3.08 MIN REP
	2.51 MAX-MIN

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

STRATUM	DF	SE	CV%
WP	5	2.18	4.9

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SERIES IV POTATOES

PERCENTAGE WARE 3.81 CM (1.5 INCH) RIDDLE

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

TREATMNT	
- - -	98.3
P6 K6 T	97.8
- - S	97.7
- - SA	98.4
- - SF	98.1
P2 - SA	98.3
P3 - SF	98.1
P4 - S	97.4
P5 - S	98.3
P5 - SF	98.8
P6 - S	97.2
- K2 SA	97.9
- K3 SF	98.4
- K4 S	98.3
- K5 S	98.7
- K5 SF	98.4
- K6 S	97.3
P1 K1 SA	97.4
P1 K3 SA	96.7
P2 K2 SA	97.3
P3 K1 SA	98.6
P3 K3 SA	98.3
P3 K4 SF	98.3
P4 K3 SF	97.5
P4 K4 S	96.9
P4 K5 S	98.0
P4 K5 SF	97.7
P4 K6 S	98.2
P5 K4 S	98.1
P5 K4 SF	97.1
P5 K5 S	97.7
P5 K6 S	96.9
P6 K4 S	97.7
P6 K5 S	97.5
P6 K6 S	97.5
MEAN	97.9

PLOT AREA HARVESTED 0.00210

\* SEDs APPLY ONLY TO - - -, P6 K6 T, - - S, - - SR, P5 - S,  
- K5 S, P4 K5 S AND P5 K4 S

TREATMNT	
MAX-MIN	- - S V ANY OF REMAINDER
MIN REP	ANY OF REMAINDER

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SERIES I SPRING BARLEY

GRAIN TONNES/HECTARE

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

TREATMNT	
- - -	7.71
P6 K6 T	7.61
- - S	7.91
- - SA	7.85
- - SF	8.01
P2 - SA	8.01
P3 - SF	7.82
P4 - S	7.90
P5 - S	7.96
P5 - SF	7.87
P6 - S	8.05
- K2 SA	7.81
- K3 SF	7.34
- K4 S	7.80
- K5 S	7.80
- K5 SF	8.11
- K6 S	7.76
P1 K1 SA	7.92
P1 K3 SA	7.80
P2 K2 SA	7.72
P3 K1 SA	8.05
P3 K3 SA	7.63
P3 K4 SF	8.37
P4 K3 SF	7.90
P4 K4 S	8.10
P4 K5 S	7.66
P4 K5 SF	7.72
P4 K6 S	7.45
P5 K4 S	7.98
P5 K4 SF	7.85
P5 K5 S	8.15
P5 K6 S	7.74
P6 K4 S	7.86
P6 K5 S	7.87
P6 K6 S	7.51
MEAN	7.84

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

TABLE	TREATMNT
-----	-----
SED	0.301 MIN REP
	0.246 MAX-MIN

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

STRATUM	DF	SE	CV%
WP	5	0.213	2.7
GRAIN MEAN DM%	80.4	PLOT AREA HARVESTED	0.00286

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SERIES II SPRING BEANS

GRAIN TONNES/HECTARE

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

TREATMNT	
- - -	4.86
P6 K6 T	5.75
- - S	5.19
- - SA	5.37
- - SF	5.41
P2 - SA	5.13
P3 - SF	4.74
P4 - S	4.92
P5 - S	5.12
P5 - SF	4.98
P6 - S	4.84
- K2 SA	5.16
- K3 SF	5.18
- K4 S	5.05
- K5 S	4.50
- K5 SF	5.36
- K6 S	4.74
P1 K1 SA	5.15
P1 K3 SA	5.38
P2 K2 SA	5.13
P3 K1 SA	4.98
P3 K3 SA	5.61
P3 K4 SF	5.69
P4 K3 SF	5.40
P4 K4 S	5.19
P4 K5 S	4.91
P4 K5 SF	4.96
P4 K6 S	5.22
P5 K4 S	4.99
P5 K4 SF	4.50
P5 K5 S	4.82
P5 K6 S	5.43
P6 K4 S	5.39
P6 K5 S	5.22
P6 K6 S	5.22
MEAN	5.15

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

TABLE	TREATMNT
-----	-----
SED	0.386 MIN REP
	0.315 MAX-MIN

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

STRATUM	DF	SE	CV%
WP	5	0.273	5.3
GRAIN MEAN DM%	84.5	PLOT AREA HARVESTED	0.00386



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SERIES III WINTER WHEAT

GRAIN TONNES/HECTARE

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

TREATMNT	
- - -	8.95
P6 K6 T	9.60
- - S	8.84
- - SA	9.56
- - SF	8.50
P2 - SA	8.90
P3 - SF	9.34
P4 - S	9.80
P5 - S	8.95
P5 - SF	9.12
P6 - S	10.37
- K2 SA	8.67
- K3 SF	9.38
- K4 S	8.13
- K5 S	9.16
- K5 SF	9.09
- K6 S	8.84
P1 K1 SA	8.53
P1 K3 SA	9.78
P2 K2 SA	8.93
P3 K1 SA	9.42
P3 K3 SA	8.86
P3 K4 SF	8.38
P4 K3 SF	8.52
P4 K4 S	8.68
P4 K5 S	9.66
P4 K5 SF	9.36
P4 K6 S	9.44
P5 K4 S	9.75
P5 K4 SF	9.60
P5 K5 S	9.50
P5 K6 S	9.35
P6 K4 S	8.88
P6 K5 S	9.50
P6 K6 S	8.81
MEAN	9.15

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

TABLE	TREATMNT
-----	-----
SED	0.968 MIN REP
	0.790 MAX-MIN

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

STRATUM	DF	SE	CV%
WP	5	0.684	7.5
GRAIN MEAN DM%	80.4	PLOT AREA HARVESTED	0.00286