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## Yields of the Field Experiments 1984

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

#### Rothamsted Research

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84/R/RN/17

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 fourth year, potatoes, s. barley, s. beans, w. wheat.

For previous years see 81-83/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 R plots, treatments repeated each autumn:

	P <sub>2</sub> O <sub>5</sub> (kg)	K <sub>2</sub> O(kg)	Tool		
- - -	0	0	Plough		(duplicated)
P6 K6 T	1000	500 to topsoil	"		( " )
- - S	0	0 " "	Wye double-digger		(four plots)
- - SR	0	0 " "	" " "		(duplicated)
P2 - SR	63	0 to subsoil	" " "		
P3 - S	125	0 " "	" " "		
P4 - S	250	0 " "	" " "		
P5 - S	500	0 " "	" " "		(duplicated)
P6 - S	1000	0 " "	" " "		
- K2 SR	0	31 " "	" " "		
- K3 S	0	63 " "	" " "		
- K4 S	0	125 " "	" " "		
- K5 S	0	250 " "	" " "		(duplicated)
- K6 S	0	350 " "	" " "		
P1 K1 SR	31	16 " "	" " "		
P1 K3 SR	31	63 " "	" " "		
P2 K2 SR	63	31 " "	" " "		
P3 K1 SR	125	16 " "	" " "		
P3 K3 SR	125	63 " "	" " "		
P3 K4 S	125	125 " "	" " "		
P4 K3 S	250	63 " "	" " "		
P4 K4 S	250	125 " "	" " "		
P4 K5 S	250	250 " "	" " "		(duplicated)
P4 K6 S	250	350 " "	" " "		
P5 K4 S	500	125 " "	" " "		(duplicated)
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 other than R were conventionally ploughed in autumn 1981, 1982 and 1983.
- (4) The rate of 350 kg  $K_2O$  applied was in error for 500 kg  $K_2O$ .

Standard applications:

- Potatoes: Manures: (10:10:15 + 4.5 Mg) at 1960 kg. Weedkillers: Paraquat at 0.50 kg ion with linuron at 1.3 kg in 500 l. Glyphosate at 1.4 kg in 250 l. Fungicides: Fentin hydroxide at 0.28 kg in 200 l on seven occasions, with the insecticide on the first, third, fourth and sixth occasions. Insecticide: Pirimicarb at 0.14 kg on four occasions. Haulm desiccant: Diquat at 0.56 kg ion in 200 l.
- S. barley: Manures: (20:10:10) at 630 kg. Weedkillers: 3, 6-dichloropicolinic acid at 0.07 kg and bromoxynil at 0.34 kg with mecoprop (as 'CMPP' at 4.2 l) applied with the fungicide in 250 l. Fungicide: Tridemorph at 0.52 kg.
- S. beans: Weedkillers: Glyphosate at 1.4 kg in 250 l. Simazine at 1.2 l in 250 l. Insecticide: Phorate at 5.6 kg.
- W. wheat: Manures: (0:18:36) at 350 kg. 'Nitro-Chalk' at 750 kg. Weedkillers: Mecoprop at 2.0 kg, ioxynil at 0.25 kg and bromoxynil at 0.25 kg in 200 l. Fungicide: Propiconazole at 0.25 kg in 500 l. Insecticide: Pirimicarb at 0.14 kg in 250 l.

- Seed: Potatoes: Pentland Crown.
- S. barley: Triumph, dressed with triadimenol and fuberidazole, sown at 160 kg.
- S. beans: Minden, sown at 240 kg.
- W. wheat: Avalon, sown at 190 kg.

Cultivations, etc.:-

- All crops: Treatments applied by double digger: 7-10 Nov, 1983. Ploughed: 11 Nov.
- Potatoes: Glyphosate applied: 6 Oct, 1983. Heavy spring-tine cultivated twice: 16 Jan, 1984 and a third time: 14 Feb. NPK Mg applied: 3 Apr. Spiked rotary cultivated, potatoes planted: 4 Apr. Rotary ridged: 6 Apr. Linuron and paraquat applied: 3 May. Fentin hydroxide with the insecticide applied: 19 June, 17 July, 30 July, 28 Aug. Fentin hydroxide applied: 3 July, 13 Aug, 11 Sept. Haulm mechanically destroyed: 3 Oct. Desiccant applied: 4 Oct. Lifted: 24 Oct.
- S. barley: Spring-tine cultivated: 14 Nov, 1983. Heavy spring-tine cultivated: 14 Feb, 1984. NPK applied: 7 Mar. Spring-tine cultivated, rotary harrowed, seed sown: 8 Mar. Weedkillers and fungicide applied: 23 May. Combine harvested: 17 Aug.
- S. beans: Glyphosate applied: 6 Oct, 1983. Heavy spring-tine cultivated twice: 16 Jan, 1984, and a third time: 14 Feb. Insecticide applied, heavy spring-tine cultivated, rotary harrowed, seed sown: 20 Mar. Simazine applied: 22 Mar. Combine harvested: 31 Aug.
- W. wheat: Glyphosate applied: 6 Oct, 1983. Spring-tine cultivated, PK applied, spring-tine cultivated, rotary harrowed, seed sown: 14 Nov. N applied: 9 Apr, 1984. Weedkillers applied: 19 Apr. Fungicide applied: 14 June. Insecticide applied: 26 June. Combine harvested: 22 Aug.

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SERIES II POTATOES

TOTAL TUBERS TONNES/HECTARE

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

TREATMNT	
- - -	57.7
P6 K6 T	66.1
- - S	61.3
- - SR	56.8
P2 - SR	53.1
P3 - S	52.3
P4 - S	59.0
P5 - S	63.0
P6 - S	57.7
- K2 SR	60.1
- K3 S	62.4
- K4 S	61.3
- K5 S	64.1
- K6 S	58.1
P1 K1 SR	52.4
P1 K3 SR	62.3
P2 K2 SR	55.7
P3 K1 SR	61.5
P3 K3 SR	60.8
P3 K4 S	58.3
P4 K3 S	58.9
P4 K4 S	59.3
P4 K5 S	65.1
P4 K6 S	61.8
P5 K4 S	63.1
P5 K5 S	65.6
P5 K6 S	64.2
P6 K4 S	62.0
P6 K5 S	60.9
P6 K6 S	65.6
MEAN	60.8

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

TABLE	TREATMNT*
SED	2.91 MIN REP 2.30 MAX-MIN

\* SED APPLIES 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 THE REMAINDER

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

STRATUM	DF	SE	CV%
WP	10	2.06	3.4

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SERIES II POTATOES

PERCENTAGE WARE 3.81 CM (1.5 INCH) RIDDLE

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

TREATMNT	
- - -	98.0
P6 K6 T	98.4
- - S	98.0
- - SR	98.0
P2 - SR	98.1
P3 - S	98.3
P4 - S	98.8
P5 - S	97.6
P6 - S	98.2
- K2 SR	97.7
- K3 S	98.2
- K4 S	98.6
- K5 S	98.7
- K6 S	97.7
P1 K1 SR	99.2
P1 K3 SR	98.8
P2 K2 SR	98.9
P3 K1 SR	98.3
P3 K3 SR	98.8
P3 K4 S	99.1
P4 K3 S	98.7
P4 K4 S	98.0
P4 K5 S	98.0
P4 K6 S	98.1
P5 K4 S	98.2
P5 K5 S	98.4
P5 K6 S	98.5
P6 K4 S	97.6
P6 K5 S	98.4
P6 K6 S	97.7
MEAN	98.2

PLOT AREA HARVESTED 0.00210

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SERIES III SPRING BARLEY

GRAIN TONNES/HECTARE

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

TREATMNT	
- - -	9.22
P6 K6 T	9.37
- - S	9.17
- - SR	9.13
P2 - SR	9.22
P3 - S	9.31
P4 - S	9.47
P5 - S	9.21
P6 - S	9.71
- K2 SR	9.01
- K3 S	9.51
- K4 S	9.01
- K5 S	9.20
- K6 S	8.72
P1 K1 SR	9.06
P1 K3 SR	9.37
P2 K2 SR	9.17
P3 K1 SR	9.33
P3 K3 SR	9.37
P3 K4 S	8.80
P4 K3 S	9.19
P4 K4 S	9.41
P4 K5 S	9.41
P4 K6 S	9.54
P5 K4 S	9.15
P5 K5 S	9.45
P5 K6 S	9.37
P6 K4 S	9.25
P6 K5 S	9.40
P6 K6 S	9.35
MEAN	9.25

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

TABLE	TREATMNT*
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SED	0.196 MIN REP
	0.155 MAX-MIN

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

STRATUM	DF	SE	CV%
WP	10	0.139	1.5

GRAIN MEAN DM% 85.7

PLOT AREA HARVESTED 0.00286

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SERIES IV SPRING BEANS

GRAIN TONNES/HECTARE

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

TREATMNT	
- - -	4.50
P6 K6 T	4.06
- - S	4.14
- - SR	4.42
P2 - SR	4.73
P3 - S	4.89
P4 - S	4.57
P5 - S	4.61
P6 - S	3.23
- K2 SR	6.06
- K3 S	4.15
- K4 S	4.31
- K5 S	4.25
- K6 S	4.86
P1 K1 SR	4.67
P1 K3 SR	4.16
P2 K2 SR	4.80
P3 K1 SR	5.22
P3 K3 SR	4.41
P3 K4 S	5.00
P4 K3 S	3.78
P4 K4 S	3.62
P4 K5 S	4.62
P4 K6 S	4.41
P5 K4 S	3.89
P5 K5 S	3.74
P5 K6 S	4.04
P6 K4 S	4.04
P6 K5 S	3.88
P6 K6 S	3.95
MEAN	4.34

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

TABLE	TREATMNT*
SED	0.453 MIN REP 0.358 MAX-MIN

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

STRATUM	DF	SE	CV%
WP	10	0.320	7.4
GRAIN MEAN DM%	88.0		
PLOT AREA HARVESTED	0.00386		

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SERIES I WINTER WHEAT

GRAIN TONNES/HECTARE

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

TREATMNT	
- - -	9.84
P6 K6 T	10.34
- - S	9.73
- - SR	10.56
P2 - SR	11.19
P3 - S	11.92
P4 - S	10.66
P5 - S	10.48
P6 - S	10.94
- K2 SR	11.02
- K3 S	10.32
- K4 S	10.13
- K5 S	9.97
- K6 S	10.44
P1 K1 SR	10.06
P1 K3 SR	10.36
P2 K2 SR	10.04
P3 K1 SR	10.37
P3 K3 SR	11.49
P3 K4 S	9.75
P4 K3 S	10.64
P4 K4 S	10.36
P4 K5 S	10.26
P4 K6 S	10.24
P5 K4 S	10.76
P5 K5 S	10.04
P5 K6 S	10.40
P6 K4 S	10.03
P6 K5 S	9.08
P6 K6 S	10.08
MEAN	10.32

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

TABLE	TREATMNT
SED	0.449 MIN REP
	0.355 MAX-MIN

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

STRATUM	DF	SE	CV%
WP	10	0.317	3.1

GRAIN MEAN DM% 86.7

PLOT AREA HARVESTED 0.00286