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# Yields of the Field Experiments 1985

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

### Rothamsted Research

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

For previous years see 81-84/R/RN/17.

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

Whole plot dimensions: 3.0 x 14.0.

Treatments to each series:

TREATMENT 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: Chalk at 5.0 t. (10:10:15+4.5 Mg) at 1960 kg.  
Weedkillers: Linuron at 1.3 kg with paraquat at 0.50 kg ion in 500 l. Fungicides: Mancozeb at 1.4 kg in 200 l on four occasions, with the insecticide on the second and third. Fentin hydroxide at 0.28 kg in 200 l on two occasions. Insecticide: Pirimicarb at 0.14 kg on two occasions.
- S. barley: Manures: Chalk at 5.0 t. (20:10:10) at 630 kg.  
Weedkillers: Clopyralid at 0.05 kg with bromoxynil octanoate at 0.24 kg, mecoprop (as 'CMPP' at 3.0 l) applied with the fungicide in 200 l. Fungicide: Tridemorph at 0.52 kg.
- S. beans: Manures: Chalk at 5.0 t. Weedkiller: Simazine at 1.2 kg in 200 l. Fungicide: Benomyl at 0.50 kg, applied with the pirimicarb and a wetting agent ('Agral' at 0.075 l) in 500 l. Insecticides: Phorate at 5.6 kg. Pirimicarb at 0.14 kg.
- W. wheat. Manures: Chalk at 5.0 t. (0:18:36) at 350 kg. 'Nitro-Chalk' (27.5% N) at 540 kg. Weedkillers: Clopyralid at 0.05 kg with bromoxynil octanoate at 0.24 kg and mecoprop (as 'CMPP' at 3.0 l), applied with the tridemorph in 200 l. Fungicides: Tridemorph at 0.52 kg. Propiconazole at 0.25 kg with carbendazim and maneb (as 'Septal' at 2.5 kg) in 200 l. Insecticide: Pirimicarb at 0.14 kg in 200 l.

- Seed: Potatoes: Pentland Crown.  
S. barley: Klaxon, sown at 160 kg.  
S. beans: Minden, sown at 240 kg.  
W. wheat: Avalon, sown at 200 kg.

Cultivations, etc.:-

- All crops: Chalk applied: 2 Oct, 1984. Treatments applied by double-digger: 14-19 Nov. Ploughed: 26 Nov. Spring-tine cultivated (twice for w. wheat): 11 Dec.
- Potatoes: Spring-tine cultivated: 12 Mar, 1985. NPK Mg applied: 3 Apr. Rotary harrowed, potatoes planted: 9 Apr. Rotary ridged: 30 Apr. Weedkillers applied: 16 May. Mancozeb applied: 20 June, 3 July, 23 July, 6 Aug with pirimicarb on the second and third occasion. Fentin hydroxide applied: 21 Aug, 11 Sept. Haulm mechanically destroyed: 17 Sept. Lifted: 16 Oct.
- S. barley: NPK applied: 11 Mar, 1985. Spring-tine cultivated, rotary harrowed, seed sown: 12 Mar. Weedkillers and fungicide applied: 16 May. Combine harvested: 21 Aug.
- S. beans: Phorate applied: 11 Mar, 1985. Spring-tine cultivated, rotary harrowed, seed sown: 12 Mar. Weedkiller applied: 13 Mar. Benomyl and pirimicarb applied: 8 July. Combine harvested: 25 Sept.

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Cultivations, etc.:- (continued)

W.wheat: PK applied: 11 Dec, 1984. Seed sown, spring-tine cultivated: 13 Dec. N applied: 16 Apr, 1985. Weedkillers and tridemorph applied: 16 May. Propiconazole, carbendazim and maneb applied: 3 July. Insecticide applied: 10 July. Combine harvested: 6 Sept.



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SERIES I POTATOES

TOTAL TUBERS TONNES/HECTARE

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

TREATMNT	
- - -	57.6
P6 K6 T	61.8
- - S	56.8
- - SA	63.0
- - SF	58.5
P2 - SA	60.0
P3 - SF	76.3
P4 - S	60.5
P5 - S	62.2
P5 - SF	60.2
P6 - S	65.1
- K2 SA	74.1
- K3 SF	66.5
- K4 S	57.1
- K5 S	60.2
- K5 SF	66.5
- K6 S	63.8
P1 K1 SA	63.0
P1 K3 SA	62.1
P2 K2 SA	62.8
P3 K1 SA	55.9
P3 K3 SA	68.2
P3 K4 SF	61.3
P4 K3 SF	66.4
P4 K4 S	63.0
P4 K5 S	61.3
P4 K5 SF	66.1
P4 K6 S	64.2
P5 K4 S	67.0
P5 K4 SF	66.0
P5 K5 S	64.3
P5 K6 S	58.5
P6 K4 S	61.7
P6 K5 S	61.2
P6 K6 S	64.0
MEAN	63.1

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

TABLE	TREATMNT*
-----	-----
SED	3.07 MIN REP
	2.51 MAX-MIN

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

STRATUM	DF	SE	CV%
WP	5	2.17	3.5

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SERIES I POTATOES

PERCENTAGE WARE 3.81 CM (1.5 INCH) RIDDLE

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

TREATMNT	
- - -	96.2
P6 K6 T	95.8
- - S	96.6
- - SA	97.7
- - SF	95.4
P2 - SA	97.9
P3 - SF	96.8
P4 - S	97.1
P5 - S	96.3
P5 - SF	94.6
P6 - S	97.3
- K2 SA	97.4
- K3 SF	96.4
- K4 S	96.9
- K5 S	97.3
- K5 SF	94.9
- K6 S	97.3
P1 K1 SA	97.7
P1 K3 SA	96.5
P2 K2 SA	96.2
P3 K1 SA	96.4
P3 K3 SA	96.9
P3 K4 SF	95.5
P4 K3 SF	97.2
P4 K4 S	94.9
P4 K5 S	95.1
P4 K5 SF	96.8
P4 K6 S	97.8
P5 K4 S	96.6
P5 K4 SF	97.3
P5 K5 S	97.0
P5 K6 S	96.9
P6 K4 S	96.3
P6 K5 S	97.5
P6 K6 S	97.0
MEAN	96.6

PLOT AREA HARVESTED 0.00210

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

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

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SERIES II SPRING BARLEY

GRAIN TONNES/HECTARE

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

TREATMNT	
- - -	5.65
P6 K6 T	5.17
- - S	5.62
- - SA	5.43
- - SF	5.26
P2 - SA	5.57
P3 - SF	5.61
P4 - S	5.48
P5 - S	5.47
P5 - SF	4.82
P6 - S	5.55
- K2 SA	5.62
- K3 SF	5.40
- K4 S	5.58
- K5 S	5.70
- K5 SF	5.18
- K6 S	5.82
P1 K1 SA	5.45
P1 K3 SA	5.52
P2 K2 SA	5.34
P3 K1 SA	5.50
P3 K3 SA	5.33
P3 K4 SF	5.13
P4 K3 SF	5.03
P4 K4 S	5.31
P4 K5 S	5.35
P4 K5 SF	5.00
P4 K6 S	5.22
P5 K4 S	5.15
P5 K4 SF	5.10
P5 K5 S	5.09
P5 K6 S	5.51
P6 K4 S	4.92
P6 K5 S	5.82
P6 K6 S	4.98
MEAN	5.38

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

TABLE	TREATMNT*
-----	-----
SED	0.277 MIN REP
	0.226 MAX-MIN

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

STRATUM	DF	SE	CV%
WP	5	0.196	3.6
GRAIN MEAN DM%	80.2	PLOT AREA HARVESTED	0.00420

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SERIES III SPRING BEANS

GRAIN TONNES/HECTARE

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

TREATMNT	
- - -	4.86
P6 K6 T	5.57
- - S	6.05
- - SA	6.20
- - SF	5.84
P2 - SA	6.37
P3 - SF	6.31
P4 - S	5.96
P5 - S	6.07
P5 - SF	5.69
P6 - S	5.64
- K2 SA	5.64
- K3 SF	5.32
- K4 S	4.44
- K5 S	5.78
- K5 SF	5.81
- K6 S	5.86
P1 K1 SA	6.40
P1 K3 SA	6.23
P2 K2 SA	6.08
P3 K1 SA	6.17
P3 K3 SA	5.56
P3 K4 SF	5.85
P4 K3 SF	6.08
P4 K4 S	5.65
P4 K5 S	5.58
P4 K5 SF	5.36
P4 K6 S	6.18
P5 K4 S	6.58
P5 K4 SF	5.58
P5 K5 S	5.71
P5 K6 S	5.62
P6 K4 S	4.87
P6 K5 S	5.64
P6 K6 S	5.60
MEAN	5.77

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

TABLE	TREATMNT*
-----	-----
SED	0.570 MIN REP
	0.465 MAX-MIN

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

STRATUM	DF	SE	CV%
WP	5	0.403	7.0
GRAIN MEAN DM%	83.5	PLOT AREA HARVESTED	0.00386



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SERIES IV WINTER WHEAT

GRAIN TONNES/HECTARE

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

TREATMNT	
- - -	5.91
P6 K6 T	6.10
- - S	5.61
- - SA	5.44
- - SF	6.13
P2 - SA	5.15
P3 - SF	5.51
P4 - S	5.65
P5 - S	6.07
P5 - SF	4.89
P6 - S	5.45
- K2 SA	5.33
- K3 SF	6.04
- K4 S	5.80
- K5 S	5.94
- K5 SF	5.88
- K6 S	5.82
P1 K1 SA	5.67
P1 K3 SA	6.05
P2 K2 SA	5.25
P3 K1 SA	4.99
P3 K3 SA	6.46
P3 K4 SF	5.12
P4 K3 SF	6.21
P4 K4 S	5.87
P4 K5 S	5.79
P4 K5 SF	5.32
P4 K6 S	6.46
P5 K4 S	6.09
P5 K4 SF	5.82
P5 K5 S	6.04
P5 K6 S	5.78
P6 K4 S	4.92
P6 K5 S	6.12
P6 K6 S	5.80
MEAN	5.73

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

TABLE	TREATMNT*
SED	0.397 MIN REP 0.324 MAX-MIN

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

STRATUM	DF	SE	CV%
WP	5	0.281	4.9
GRAIN MEAN DM%	77.2	PLOT AREA HARVESTED	0.00420