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# Yields of the Field Experiments 1981

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

### 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 & 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 first year, potatoes, s. barley, s. beans, w. wheat.

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

Whole plot dimensions: 3.0 x 14.

Treatments to each series:

TREATMNT	Extra P & K and primary cultivation tool:					
	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		(six plots)
P2 - S	63	0 to subsoil		"	"	"
P3 - S	125	0	" "	"	"	"
P4 - S	250	0	" "	"	"	"
P5 - S	500	0	" "	"	"	" (duplicated)
P6 - S	1000	0	" "	"	"	"
- K2 S	0	31	" "	"	"	"
- K3 S	0	63	" "	"	"	"
- K4 S	0	125	" "	"	"	"
- K5 S	0	250	" "	"	"	" (duplicated)
- K6 S	0	350	" "	"	"	"
P1 K1 S	31	16	" "	"	"	"
P1 K3 S	31	63	" "	"	"	"
P2 K2 S	63	31	" "	"	"	"
P3 K1 S	125	16	" "	"	"	"
P3 K3 S	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	" "	"	"	"

- 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 & K this was distributed ahead of the rotary cultivator.  
 (2) The topsoil PK dressing was equally divided before and after ploughing.

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- (3) Treatments shown are those for the first year only and provide for comparisons of frequency of application.
- (4) The rate of 350 kg K<sub>2</sub>O applied was in error for 500 kg K<sub>2</sub>O.

Standard applications:

- All crops: Weedkillers: Glyphosate at 1.5 l in 250 l.  
Potatoes: Manures: (10:10:15 + 4.5 Mg) at 1960 kg. Weedkillers: Linuron at 1.13 with paraquat at 0.4 kg ion in 250 l. Fungicides: Mancozeb at 1.4 kg in 250 l applied six times, with pirimicarb on the first five. Insecticide: Pirimicarb at 0.14 kg.  
S. barley: Manures: (20:10:10) at 450 kg. Weedkillers: Mecoprop with bromoxynil and ioxynil (as 'Brittox' at 2.5 l) in 250 l applied with the fungicide. Fungicide: Tridemorph at 0.53 kg. Prochloraz at 0.4 l in 250 l.  
S beans: Weedkiller: Simazine at 1.2 kg in 250 l. Fungicide: Benomyl at 0.55 kg in 250 l applied with the pirimicarb. Insecticides: Phorate at 5.6 kg. Pirimicarb at 0.14 kg.  
W. wheat: Manures: (0:20:20) at 310 kg, 'Nitro-Chalk' at 560 kg. Weedkillers: Mecoprop with bromoxynil and ioxynil (as 'Brittox' at 3.7 l) in 250 l. Fungicides: Prochloraz at 0.4 l in 250 l applied twice, with maneb at 1.2 kg and zineb at 0.13 kg on the second occasion.

Seed: Potatoes: Pentland Crown.

- S. barley: Triumph, seed dressed with ethirimol, sown at 160 kg.  
S. beans: Minden, sown at 280 kg.  
W. wheat: Flanders, sown at 200 kg.

Cultivations, etc.:-

- All crops: Glyphosate applied: 24 Sept, 1980. Treatments applied by double digger: 23-31 Oct. Half topsoil PK treatment applied & ploughed in: 10 Nov. Second half topsoil PK treatment applied: 11 Nov.  
Potatoes: Chisel ploughed: 21 Nov, 1980. NPK applied: 14 Apr, 1981. Spike rotary cultivated, potatoes planted: 30 Apr. Weedkillers applied: 21 May. Fungicide with insecticide applied: 22 June, 1 July, 13 July, 27 July, and 12 Aug. Fungicide applied: 24 Aug. Haulm mechanically destroyed: 7 Oct. Lifted: 22 Oct.  
S. barley: Chisel ploughed: 21 Nov, 1980. Spring-tine cultivated, NPK applied: 17 Feb, 1981. Spring-tine cultivated, seed sown by combined drill and rotary harrow: 18 Feb. Weedkillers and tridemorph applied: 12 May. Prochloraz applied: 8 July. Combine harvested: 17 Aug.  
S. beans: Chisel ploughed: 21 Nov, 1980. Spring-tine cultivated: 17 Feb, 1981. Phorate applied, spring-tine cultivated, seed sown by combined drill and rotary harrow: 18 Feb. Weedkiller applied: 9 Apr. Pirimicarb and fungicide applied: 18 June. Combine harvested: 8 Sept.  
W. wheat: Heavy spring-tine cultivated, PK applied, spring-tine cultivated: 11 Nov, 1980. Seed sown by combined drill and rotary harrow: 12 Nov. N applied: 13 Apr, 1981. Weedkillers applied: 22 Apr. Prochloraz applied: 5 May. Prochloraz applied with maneb and zineb: 19 June. Combine harvested: 24 Aug.

Previous crops: W. wheat 1979, s. barley 1980.

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POTATOES SERIES I

TOTAL TUBERS TONNES/HECTARE

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

TREATMNT	
- - -	61.7
P6 K6 T	68.3
- - S	61.3
P2 - S	71.8
P3 - S	62.3
P4 - S	63.3
P5 - S	59.2
P6 - S	67.1
- K2 S	65.9
- K3 S	64.1
- K4 S	70.4
- K5 S	69.7
- K6 S	72.1
P1 K1 S	66.7
P1 K3 S	65.0
P2 K2 S	51.4
P3 K1 S	61.6
P3 K3 S	63.4
P3 K4 S	64.4
P4 K3 S	54.8
P4 K4 S	54.8
P4 K5 S	64.4
P4 K6 S	75.7
P5 K4 S	63.6
P5 K5 S	65.0
P5 K6 S	71.0
P6 K4 S	67.0
P6 K5 S	75.9
P6 K6 S	72.3
MEAN	64.7

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

TABLE	TREATMNT*
SED	4.58 MIN REP
	3.74 MAX-MIN

\* SED APPLIES ONLY TO - - -, P6 K6 T, - - S, P5 - S, - K5 S, P4 K6 S and P5 K4 S.

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

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

STRATUM	DF	SE	CV%
WP	11	4.58	7.1

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POTATOES SERIES I

PERCENTAGE WARE 3.81 CM (1.5 INCH) RIDDLE

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

TREATMNT	
- - -	96.1
P6 K6 T	97.5
- - S	97.4
P2 - S	98.0
P3 - S	97.3
P4 - S	96.9
P5 - S	97.7
P6 - S	97.7
- K2 S	97.3
- K3 S	97.2
- K4 S	98.2
- K5 S	96.7
- K6 S	97.5
P1 K1 S	97.7
P1 K3 S	97.4
P2 K2 S	97.2
P3 K1 S	96.3
P3 K3 S	97.9
P3 K4 S	97.7
P4 K3 S	97.5
P4 K4 S	98.3
P4 K5 S	97.7
P4 K6 S	97.7
P5 K4 S	97.7
P5 K5 S	98.1
P5 K6 S	97.0
P6 K4 S	98.3
P6 K5 S	98.1
P6 K6 S	98.2
MEAN	97.5

PLOT AREA HARVESTED 0.00210

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GRAIN TONNES/HECTARE

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

TREATMNT	
- - -	5.86
P6 K6 T	7.30
- - S	6.44
P2 - S	6.37
P3 - S	6.39
P4 - S	7.05
P5 - S	6.74
P6 - S	6.95
- K2 S	6.44
- K3 S	6.67
- K4 S	6.37
- K5 S	6.82
- K6 S	6.88
P1 K1 S	5.57
P1 K3 S	6.34
P2 K2 S	6.78
P3 K1 S	6.72
P3 K3 S	6.81
P3 K4 S	6.50
P4 K3 S	7.06
P4 K4 S	6.99
P4 K5 S	7.01
P4 K6 S	7.07
P5 K4 S	6.78
P5 K5 S	7.08
P5 K6 S	6.98
P6 K4 S	7.33
P6 K5 S	7.00
P6 K6 S	6.92
MEAN	6.70

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

TABLE	TREATMNT*
-----	-----
SED	0.374 MIN REP
	0.305 MAX-MIN

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

STRATUM	DF	SE	CV%
WP	11	0.374	5.6

GRAIN MEAN DM% 86.7

PLOT AREA HARVESTED 0.00286

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S. BEANS SERIES III

GRAIN TONNES/HECTARE

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

TREATMNT	
- - -	3.58
P6 K6 T	3.87
- - S	3.54
P2 - S	3.70
P3 - S	3.60
P4 - S	3.68
P5 - S	3.94
P6 - S	4.82
- K2 S	3.80
- K3 S	3.80
- K4 S	3.60
- K5 S	3.73
- K6 S	4.86
P1 K1 S	2.78
P1 K3 S	3.96
P2 K2 S	2.93
P3 K1 S	3.93
P3 K3 S	3.55
P3 K4 S	3.75
P4 K3 S	3.46
P4 K4 S	3.69
P4 K5 S	4.28
P4 K6 S	3.97
P5 K4 S	4.57
P5 K5 S	4.22
P5 K6 S	4.05
P6 K4 S	4.28
P6 K5 S	4.67
P6 K6 S	4.56
MEAN	3.87

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

TABLE	TREATMNT*
-----	-----
SED	0.604 MIN REP
	0.493 MAX-MIN

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

STRATUM	DF	SE	CV%
WP	11	0.604	15.6

GRAIN MEAN DM% 87.1

PLOT AREA HARVESTED 0.00341

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WINTER WHEAT SERIES IV

GRAIN TONNES/HECTARE

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

TREATMNT	
- - -	7.67
P6 K6 T	7.11
- - S	7.28
P2 - S	7.56
P3 - S	7.74
P4 - S	7.45
P5 - S	7.90
P6 - S	8.27
- K2 S	7.60
- K3 S	7.19
- K4 S	6.88
- K5 S	7.46
- K6 S	8.13
P1 K1 S	7.18
P1 K3 S	3.43
P2 K2 S	7.54
P3 K1 S	7.87
P3 K3 S	7.06
P3 K4 S	8.36
P4 K3 S	6.88
P4 K4 S	7.30
P4 K5 S	7.41
P4 K6 S	7.71
P5 K4 S	7.85
P5 K5 S	7.06
P5 K6 S	8.14
P6 K4 S	7.66
P6 K5 S	5.89
P6 K6 S	7.77
MEAN	7.38

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

TABLE	TREATMNT*
SED	0.485 MIN REP
	0.396 MAX-MIN

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

STRATUM	DF	SE	CV%
WP	11	0.485	6.6

GRAIN MEAN DM% 78.8

PLOT AREA HARVESTED 0.00286