ROTHAMSTED RESEARCH

Yields of the Field Experiments 1986

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Rothamsted Research

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ARABLE REFERENCE PLOTS

Object: To study the long-term effects of FYM and N, P and K fertilizers on the yield and mineral content of crops - Great Field IV.

Sponsors: F.V. Widdowson, A. Penny.

The 31st year of a rotation, s. barley, ley, potatoes, w. wheat, kale until 1980; w. barley, ley, potatoes, w. wheat, w. oats since 1981. The 27th year of a rotation on the additional plots (as the initial above rotation for 20 years; w. barley, ley, potatoes, w. wheat, w. oats since 1980). The 30th year of permanent grass.

For previous years see 58/Bc/1(t), 59/Bc/1(t), 60/B/3(t), 61-64/B/2, 65/B/2(t), 66/B/2(t), 67/B/2, 68/B/3(t) and 69-85/R/RN/5.

Design: 1 block of 12 plots for each crop on original plots. 1 block of 7 plots for each crop on additional plots.

Whole plot dimensions: 2.13 x 2.44.

Treatments: Fertilizers and farmyard manure:

MANURE

Original plots

0
N1
P
N1P
K
N1K
PK
N1PK
N2PK
D
N1PKD
N2PKD

N1, 2 (kg N): 20, 40 (ley): 100, 200 (w. wheat, w. barley and w. oats): 125, 250 (potatoes, and permanent grass) as 'Nitro-Chalk' (26% N)
P: 63 kg P_2O_5 as superphosphate
K: 250 kg K_2O as muriate of potash
D: 38 tonnes FYM (permanent grass): 100 tonnes (to potatoes only - 50 tonnes to potatoes and kale until 1980): none to other crops

NOTES: (1) All w. wheat on these plots receives a standard dressing of 82 kg MgO as Epsom salts.
(2) Cereals receive 20 kg of N1 and 40 kg of N2 in February or March, remainder in April.

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Additional plots

MANURE	Fertilizers from 1980 to 1986 and in previous years:
1980-86	Until 1979
0	0
N2PK	N2 PK
N2PKMG	N2 PK MG CA
N2PKS	N2 PK CA S
N2PKMGS	N2 PK MG S
N1PKMGS	N2 PK CA MG S
N3PKMGS	N2 PK CA MG S TE

N: In 1986: N1: 20 kg (ley), 120 kg (w. wheat, w. barley and w. oats), 160 kg (potatoes). N2: 30 kg (ley), 160 kg (w. wheat, w. barley and w. oats), 240 kg (potatoes). N3: 40 kg (ley), 200 kg (w. wheat, w. barley and w. oats), 320 kg (potatoes). Until 1979 N2 = larger rate on original plots in these years. As urea in all years. Cereals receive 40 kg N in March, remainder in April.
P: 126 kg P205 as potassium dihydrogen phosphate.
K: 251 kg K20 total. As potassium dihydrogen phosphate (83 kg K20) on all PK plots. In addition plots without S receive 168 kg K20 as potassium chloride, plots with S receive 92 kg K20 as potassium sulphate plus 76 kg K20 as potassium chloride. Since 1978 all PK plots receive, in addition to the standard total, 126 kg K20 for potatoes, applied in autumn as potassium chloride.
MG: 126 kg MgO as magnesium chloride.
CA: 126 kg CaO as calcium carbonate until 1979. In 1980 plots not previously given ca received calcium carbonate at 7.5 t, except 0 which was given 5.0 t.
S: 30 kg S supplied by the potassium sulphate.
TE: Trace element mixture which included Mn, Cu, Zn, B, Mo, Ca and Fe.

Standard applications:
Original plots: Manures: CaCO3 at 3.8 t.
Original and additional plots:
All cereals: Weedkillers: Dicamba, mecoprop and MCPA (as 'Polyfarmon CMPP' at 2.1 l) with mecoprop, bromoxynil and ioxynil (as 'Brittox' at 2.1 l) in 220 l. Isoproturon (except to oats) at 2.1 kg in 220 l. Fungicides: Prochloraz at 0.42 kg with benomyl at 0.28 kg in 220 l. Propiconazole at 0.13 kg with captafol at 1.0 kg in 220 l. Captafol at 1.0 kg with carbendazim at 0.15 kg, maneb at 1.6 kg and tridemorph at 0.37 kg in 220 l with the insecticide. Insecticide: Pirimicarb at 0.14 kg.
W. wheat and w. oats: Growth regulator: Chlormequat at 1.9 kg in 220 l.
W. barley: Growth regulator: Mepiquat chloride at 0.85 kg and 2-chloroethylphosphonic acid at 0.42 kg in 220 l.
Potatoes: Weedkillers: Linuron at 0.93 kg with paraquat at 0.28 kg ion in 220 l. Fungicides: Mancozeb at 1.3 kg in 220 l on three occasions, applied with the insecticide on the second and third occasions. Insecticide: Pirimicarb at 0.14 kg on two occasions.

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Seed: W. wheat: Galahad, sown at 210 kg.
W. barley: Panda, sown at 180 kg.
W. oats: Peniarth, sown at 210 kg.
Potatoes: Cara.
Grass-clover ley: RVP Italian ryegrass and Hungaropoly red clover.

Cultivations, etc.:-
Original and additional plots:
All cereals: 'Poly-farmon CMPP', 'Brittox' and (except to oats) isoproturon applied: 12 Dec, 1985. First N treatments applied: 12 Mar, 1986. Second N treatments applied: 29 Apr. Prochloraz and benomyl applied: 1 May. Growth regulators applied: 6 May. Propiconazole with captafol applied: 22 May. Captafol, carbendazim, maneb, tridemorph and the insecticide applied: 24 June.
W. wheat: $CaCO_3$ and Mg applied (to original plots only): 12 Sept, 1985. P and K applied to original plots and P, K, Mg and S applied to additional plots, rotary cultivated: 18 Sept. Raked level, seed sown and raked in: 19 Sept. Hand harvested: 13 Aug, 1986.
W. barley: $CaCO_3$ applied, rotary cultivated (to original plots only): 9 Sept, 1985. P and K applied to original plots and P, K, Mg and S applied to additional plots, rotary cultivated, raked level, seed sown and raked in: 18 Sept. Hand harvested: 28 July, 1986.
W. oats: $CaCO_3$ applied (to original plots only), all plots rotary cultivated: 9 Sept, 1985. P and K applied to original plots, P, K, Mg and S applied to additional plot and these plots only rotary cultivated, all plots raked level, seed sown and raked in: 18 Sept. Hand harvested: 6 Aug, 1986.
Potatoes: $CaCO_3$ applied (to original plots only) and extra K applied (to additional plots except nil only): 29 Nov, 1985. P and K applied (to original plots only): 10 Dec. FYM applied to original plots and P, K, Mg and S applied to additional plots, all plots dug by hand: 11 Dec. N applied, deep rotary cultivated: 8 May, 1986. Raked level, potatoes planted and ridged by hand: 9 May. Weedkillers applied: 28 May. Mancozeb applied: 24 June. Mancozeb with the insecticide applied: 16 July, 14 Aug. Plots given neither FYM nor K on original plots and plots given no fertilizer on additional plots harvested by hand: 8 Sept. Remaining plots harvested by hand: 24 Sept.
Grass-clover ley: Lightly rotary cultivated, raked level, seed sown and raked in: 12 Aug, 1985. $CaCO_3$, P and K applied to original plots and P, K, Mg and S applied to additional plots: 29 Nov. N applied: 17 Mar, 1986. Cut: 22 May, 17 July and 29 Sept. Permanent grass: $CaCO_3$, P and K applied: 29 Nov, 1985. FYM and first N applied: 17 Mar, 1986. Second N applied: 22 May. Final N applied: 18 July. Cut: 22 May, 17 July and 29 Sept.

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ORIGINAL PLOTS

TONNES/HECTARE

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

	W. WHEAT:		W. BARLEY:		LEY : DRY MATTER			
	GRAIN	STRAW	GRAIN	STRAW	1ST CUT	2ND CUT	3RD CUT	TOTAL OF 3 CUTS
MANURE								
0	4.99	4.71	2.61	2.08	1.27	2.05	1.75	5.07
N1	3.53	4.91	2.70	2.98	2.02	1.92	1.36	5.29
P	4.28	3.81	2.86	2.57	1.62	1.34	0.71	3.66
N1P	1.77	4.41	1.49	3.06	2.43	1.42	0.52	4.37
K	4.14	3.77	2.77	2.70	1.55	2.17	1.94	5.66
N1K	5.91	4.84	3.93	3.56	1.81	2.92	1.96	6.69
PK	5.34	4.89	3.98	3.43	2.85	4.66	4.71	12.22
N1PK	8.32	9.14	7.53	6.86	3.15	3.98	3.37	10.50
N2PK	9.88	9.90	8.83	7.72	3.81	4.17	3.84	11.82
D	6.16	6.27	4.68	4.15	3.15	4.18	3.28	10.61
N1PKD	9.93	9.78	8.32	7.80	3.62	4.36	4.67	12.65
N2PKD	10.66	10.96	9.38	9.83	4.12	3.96	4.34	12.42
MEAN DM%	81.0	68.0	83.0	72.6	18.9	23.8	23.9	22.2

	W. OATS:		POTATOES:	PERMANENT GRASS : DRY MATTER			
	GRAIN	STRAW	TOTAL TUBERS	1ST CUT	2ND CUT	3RD CUT	TOTAL OF 3 CUTS
MANURE							
0	3.12	2.68	9.1	0.43	0.65	0.44	1.51
N1	4.56	3.52	12.0	0.89	1.62	1.46	3.96
P	3.61	3.98	20.0	0.42	0.76	0.43	1.61
N1P	5.18	7.12	9.2	1.40	2.15	1.15	4.70
K	3.15	2.75	22.1	0.61	0.74	0.56	1.91
N1K	4.70	3.96	23.5	1.14	1.83	1.40	4.36
PK	3.31	3.49	42.7	0.51	1.04	0.55	2.10
N1PK	6.63	8.14	49.4	1.34	2.56	1.10	5.00
N2PK	7.36	9.48	46.3	3.19	2.79	2.04	8.03
D	4.34	4.19	53.6	2.61	2.02	1.19	5.83
N1PKD	7.23	8.31	64.2	3.87	2.31	1.76	7.93
N2PKD	7.38	9.53	59.6	3.69	3.29	2.35	9.32
MEAN DM%	82.3	48.8	19.9	25.8	33.7	32.8	30.8

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ADDITIONAL PLOTS

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

	W. WHEAT:		W. BARLEY:		W. OATS:		POTATOES:
	GRAIN	STRAW	GRAIN	STRAW	GRAIN	STRAW	TOTAL TUBERS
MANURE							
0	5.82	5.45	3.36	2.78	3.65	3.56	12.3
N2PK	8.95	9.07	8.98	8.70	7.11	9.36	57.3
N2PKMG	10.33	10.34	8.88	7.64	7.34	8.61	49.4
N2PKS	9.93	9.57	8.64	8.20	7.32	8.18	56.9
N2PKMGS	10.07	9.54	6.91	6.16	7.19	9.00	49.8
N1PKMGS	9.81	9.62	8.12	7.39	7.04	8.88	52.7
N3PKMGS	10.63	10.74	8.40	8.48	7.65	9.35	46.5
MEAN DM%	81.9	71.0	84.3	77.7	82.9	52.2	19.2

	LEY : DRY MATTER			
	1ST CUT	2ND CUT	3RD CUT	TOTAL OF 3 CUTS
MANURE				
0	2.06	1.49	1.18	4.74
N2PK	3.54	3.97	3.76	11.27
N2PKMG	3.10	4.41	3.79	11.30
N2PKS	3.36	4.19	4.34	11.88
N2PKMGS	3.82	4.40	4.33	12.56
N1PKMGS	3.87	3.92	4.10	11.89
N3PKMGS	3.13	3.45	3.93	10.51
MEAN DM%	16.0	24.6	21.7	20.8

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