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85/R/RN/5 Arable Reference Plots - S. Barley, Ley, Potatoes, W. Wheat, W. Oats, Old Grass

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.

Sponsor: F.V. Widdowson.

The 30th year of a rotation, s. barley, ley, potatoes, w. wheat, kale until 1980, w. barley, ley, potatoes, w. wheat, w. oats since 1981. The 25th 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 29th 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 69-84/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

O
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 P2O5 as superphosphate

K: 250 kg K2O 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 1985 and in previous years:

1980-85	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 1985: 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 P2O5 as potassium dihydrogen phosphate.
- K: 251 kg K2O total. As potassium dihydrogen phosphate (83 kg K2O) on all PK plots. In addition plots without S receive 168 kg K2O as potassium chloride, plots with S receive 92 kg K2O as potassium sulphate plus 76 kg K2O as potassium chloride. Since 1978 all PK plots receive, in addition to the standard total, 126 kg K2O 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 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 and additional plots:

- All cereals: Weedkillers: Mecoprop, bromoxynil and ioxynil (as 'Brittox' at 2.8 l) with (except for oats) chlortoluron at 3.5 kg in 220 l. Fungicides: Tridemorph at 0.52 kg in 220 l applied with the dimethoate. Prochloraz at 0.42 kg with benomyl at 0.28 kg in 220 l. Captafol at 1.0 kg with propiconazole at 0.13 kg in 220 l. Insecticide: Dimethoate at 0.67 kg.
- W. wheat: Fungicides: Maneb at 1.6 kg, carbendazim at 0.15 kg and tridemorph at 0.37 kg with captafol at 1.0 kg in 220 l applied with the pirimicarb. Insecticide: Pirimicarb at 0.14 kg. Growth regulator: Chlormequat at 1.9 kg in 220 l.
- W. barley: Growth regulator: Mepiquat chloride and ethephon (as 'Terpal' at 2.8 l) in 220 l.
- W. oats: Growth regulator: Chlormequat at 1.9 kg in 220 l.
- Potatoes: Weedkillers: Linuron at 0.93 kg with paraquat at 0.28 kg in 220 l. Fungicides: Captafol at 1.0 kg in 220 l applied with the insecticide. Mancozeb at 1.3 kg in 220 l applied with the insecticide (except for plots given neither FYM nor K on the original plots, and the plot given no fertilizers on the additional plots). Insecticide: Pirimicarb at 0.14 kg.

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Seed: W. wheat: Norman, sown at 210 kg.
W. barley: Panda, sown at 200 kg.
W. oats: Peniarth, sown at 210 kg.
Potatoes: Desiree.
Grass-clover ley: RVP Italian ryegrass and Hungaropoly red clover.

Cultivations, etc.:-

- W. wheat: Dug by hand: 12 Sept, 1984 (additional plots), 13 Sept (original plots). P, K, Mg and S applied (S to additional plots only): 13 Sept. Raked level, seed sown and raked in: 26 Sept. 'Brittox' and chlortoluron applied: 23 Oct. Tridemorph and dimethoate applied: 16 Nov. First N treatments applied: 26 Feb, 1985. Second N treatments applied: 15 Apr. Prochloraz and benomyl applied: 24 Apr. Growth regulator applied: 2 May. Captafol and propiconazole applied: 22 May. Maneb, carbendazim, tridemorph, captafol and pirimicarb applied: 27 June. Harvested by hand: 16 Aug.
- W. barley: Rotary cultivated, P and K applied to original plots: 10 Sept, 1984. P, K, Mg and S applied to additional plots: 11 Sept. Raked level, seed sown and raked in: 18 Sept. 'Brittox' and chlortoluron applied: 23 Oct. Tridemorph and dimethoate applied: 16 Nov. First N treatments applied: 26 Feb, 1985. Second N treatments applied: 15 Apr. Prochloraz and benomyl applied: 24 Apr. Growth regulator applied: 2 May. Captafol and propiconazole applied: 22 May. Harvested by hand: 1 Aug.
- W. oats: Rotary cultivated, P and K applied to original plots: 10 Sept, 1984. P, K, Mg and S applied to additional plots: 11 Sept. Raked level, seed sown, raked in: 26 Sept. 'Brittox' applied: 23 Oct. Tridemorph and dimethoate applied: 16 Nov. First N treatments applied: 26 Feb, 1985. Second N treatments applied: 15 Apr. Prochloraz and benomyl applied: 24 Apr. Growth regulator applied: 2 May. Captafol and propiconazole applied: 22 May. Harvested by hand: 8 Aug.
- Potatoes: FYM applied, dug by hand (original plots): 10 Dec, 1984. Dug by hand, P, K, Mg and S applied (additional plots), P and K applied (original plots): 11 Dec. N applied, deep rotary cultivated twice: 18 Apr, 1985. Raked level, potatoes planted and ridged by hand: 18 Apr (original plots), 19 Apr (additional plots). Weedkillers applied: 20 May. Captafol with pirimicarb applied: 27 June. Plots given neither FYM nor K on original plots, and plots given no fertilizer on additional plots harvested by hand, remaining plots mancozeb and pirimicarb applied: 24 July. These remaining plots harvested by hand: 11 Sept.
- Grass-clover ley: Lightly rotary cultivated, raked level, seed sown and raked in: 6 Aug, 1984. P and K applied (original plots): 6 Dec. P, K, Mg and S applied (additional plots): 7 Dec. N applied: 4 Mar, 1985. Cut: 21 May, 18 July, 24 Sept.
- Permanent grass: P and K applied: 6 Dec, 1984. First N applied: 4 Mar, 1985. FYM applied: 11 Mar. Second N applied: 21 May. Final N applied: 18 July. Cut: 20 May, 18 July, 24 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								
O	4.49	4.35	3.09	2.22	1.34	1.44	0.95	3.73
N1	6.42	5.91	5.39	4.37	2.26	1.55	0.72	4.53
P	5.95	5.51	1.59	1.85	1.55	2.53	2.48	6.57
N1P	3.17	4.56	2.84	4.79	2.86	1.60	0.44	4.90
K	4.75	4.35	2.41	2.41	1.92	2.07	1.79	5.78
N1K	7.70	6.79	6.37	5.16	2.79	2.08	1.36	6.24
PK	5.65	5.39	3.48	2.41	2.41	4.81	4.14	11.36
N1PK	9.46	8.89	8.26	6.64	2.95	4.40	3.95	11.30
N2PK	10.82	10.85	10.06	9.04	4.24	2.94	3.45	10.63
D	7.63	7.34	5.34	3.92	2.50	3.22	3.30	9.02
N1PKD	11.12	12.34	8.97	7.22	3.94	4.12	4.80	12.85
N2PKD	11.93	12.92	10.01	9.24	4.91	3.44	3.65	12.00
MEAN DM%	77.1	54.4	80.0	56.6	22.4	24.8	22.1	23.1

	W. OATS:		POTATOES:	PERMANENT GRASS : DRY MATTER			
	GRAIN	STRAW	TOTAL TUBERS	1ST CUT	2ND CUT	3RD CUT	TOTAL OF 3 CUTS
MANURE							
O	3.35	4.33	9.6	0.60	1.34	0.66	2.59
N1	5.92	8.92	9.6	0.83	2.35	1.62	4.80
P	3.59	4.39	11.1	0.47	1.69	0.70	2.85
N1P	5.92	7.17	9.6	1.53	2.59	2.01	6.13
K	2.88	5.15	17.3	0.66	1.76	0.78	3.20
N1K	5.54	8.85	31.1	1.72	3.14	1.67	6.53
PK	3.27	5.58	38.8	0.67	1.59	0.93	3.19
N1PK	7.27	12.00	56.9	3.09	3.16	2.17	8.42
N2PK	8.48	14.62	58.8	4.00	3.87	2.93	10.79
D	4.13	7.61	62.3	4.24	2.60	1.83	8.66
N1PKD	7.95	12.04	82.8	5.59	3.87	2.77	12.23
N2PKD	7.79	17.27	87.3	6.10	4.91	3.59	14.60
MEAN DM%	75.9	41.3	22.1	25.9	20.3	23.6	23.3

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ADDITIONAL PLOTS

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

	W. WHEAT:		W. BARLEY:		W. OATS:		POTATOES:
	GRAIN	STRAW	GRAIN	STRAW	GRAIN	STRAW	TOTAL TUBERS
MANURES							
0	5.06	4.53	3.05	2.61	3.68	5.08	8.6
N2PK	10.67	11.10	10.04	8.19	7.17	12.93	61.3
N2PKMG	9.87	9.47	9.17	8.12	7.48	13.03	68.0
N2PKS	10.38	10.05	9.36	8.27	7.02	11.09	63.0
N2PKMGS	10.59	11.32	9.61	7.91	6.78	11.43	59.8
N1PKMGS	9.53	9.12	9.01	8.29	7.23	12.47	60.5
N3PKMGS	10.29	10.84	10.05	7.56	7.16	7.68	61.9
MEAN DM%	77.9	55.1	80.5	62.4	75.4	44.0	23.9

	LEY : DRY MATTER			
	1ST CUT	2ND CUT	3RD CUT	TOTAL OF 3 CUTS
MANURES				
0	1.92	1.55	0.94	4.41
N2PK	4.00	3.10	3.63	10.72
N2PKMG	3.75	3.63	3.72	11.10
N2PKS	3.00	3.37	3.72	10.10
N2PKMGS	3.72	3.48	3.70	10.90
N1PKMGS	2.81	4.07	3.65	10.54
N3PKMGS	4.07	3.36	3.57	10.99
MEAN DM%	22.2	22.6	23.0	22.6