ROTHAMSTED RESEARCH

Yields of the Field Experiments 1979

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79/R/WW/2 and 79/W/WW/2 Aqueous N and Nitrification Inhibitors - W. Wheat

Rothamsted Research

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79/R/WW/2 and 79/W/WW/2

WINTER WHEAT

AQUEOUS N AND NITRIFICATION INHIBITORS

Object: To study the effects of adding nitrification inhibitors to aqueous urea on the yield and nitrogen uptake of winter wheat. At Rothamsted only, the effects of conventional and direct drilling are also studied - Rothamsted (R) Pastures and Woburn (W) Warren Field I.

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

Design: 2 randomised blocks each containing 4 sub-blocks of 3 plots, plus 6 extra plots. At Rothamsted another factor (drilling) was applied to half-blocks in a criss-cross manner.

Whole plot dimensions: Pastures (R): 4.27 x 29.0.
Warren Field I (W): 4.27 x 12.2.

Treatments: All combinations of:-

Sub-blocks (SB)

1. AQ N AUT — Rates of nitrogen (kg N) injected in autumn as aqueous urea:

   50
   100

2. TOTAL N — Total rates of nitrogen (kg N), part applied in autumn (AQ N AUT), part in spring as 'Nitro-Chalk':

   150 — Total 150 (100 in spring to AQ N AUT 50, 50 in spring to AQ N AUT 100)
   200 — Total 200 (150 in spring to AQ N AUT 50, 100 in spring to AQ N AUT 100)

Plots (WP)

3. N INHIB — Nitrification inhibitors added to aqueous urea:

   NITRAPYR — Nitrapyrin at 1.5 kg
   PEX 2 — Potassium ethyl xanthate at 2 kg
   PEX 10 — Potassium ethyl xanthate at 10 kg

plus six extra plots given 'Nitro-Chalk' only in spring (kg N):

   EXTRA

   0
   NC 50
   NC 100
   NC 150
   NC 200
   NC 250

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Half-blocks (HB) (R only)

4. DRILLING Drilling method:

CNVNTIAL	Conventional
DIRECT	Direct drilled

NOTE: 'Nitro-Chalk' dressings were divided, two-thirds in April, one-third in May.

Basal applications:
Pastures (R): Manures: (0:20:20) at 310 kg, combine drilled. Weedkillers: Paraquat at 0.42 kg ion in 220 l. Mecoprop at 2.5 kg in 220 l. Growth regulator: Chlormequat at 1.7 kg in 220 l.
Warren Field I (W): Manures: (0:20:20) at 310 kg. Weedkillers: Dicamba with mecoprop and MCPA ('Banlene Plus' at 4.9 kg in 250 l). Growth regulator: Chlormequat at 1.7 kg in 250 l.

Seed: Pastures (R): Flanders, sown at 190 kg.
Warren Field I (W): Maris Kinsman, sown at 190 kg.

Cultivations, etc.:-
Pastures (R): 'CNVNTIAL': Chisel ploughed twice: 6 Oct, 1978. Aqueous N with inhibitors injected: 9 Oct. All plots disc harrowed, seed sown, 'CNVNTIAL' plots harrowed in, 'DIRECT' plots disced in: 12 Oct. Paraquat applied: 23 Oct. 'Nitro-Chalk' applied: 20 Apr, 1979. Mecoprop applied: 9 May. 'Nitro-Chalk' applied: 17 May. Growth regulator applied: 1 June. Combine harvested: 29 Aug. Previous cropping: Beans 1977, wheat 1978.
Warren Field I (W): Heavy spring-tine cultivated: 11 Sept, 1978. Deep-tine cultivated: 18 Sept. Aqueous N with inhibitors injected: 10 Oct. PK applied: 17 Oct. Disc harrowed twice: 13-14 Nov. Seed sown: 14 Nov. 'Nitro-Chalk' applied: 23 Apr, 1979. Weedkiller applied: 15 May. 'Nitro-Chalk' applied: 18 May. Growth regulator applied: 1 June. Combine harvested: 31 Aug. Previous cropping: Potatoes 1977, wheat 1978.

NOTE: At Rothamsted only soil samples were taken at monthly intervals, November to July for measurements of nitrate and ammonia.

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79/R/WW/2 PASTURES(R)

GRAIN TONNES/HECTARE

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

N INHIB AQ N AUT	NITRAPYR	PEX 2	PEX 10	MEAN
50	5.70	5.17	5.55	5.47
100	6.01	5.61	5.42	5.68
MEAN	5.85	5.39	5.48	5.58

TOTAL N AQ N AUT	150	200	MEAN
50	5.38	5.56	5.47
100	5.20	6.17	5.68
MEAN	5.29	5.86	5.58

TOTAL N N INHIB	150	200	MEAN
NITRAPYR	5.68	6.02	5.85
PEX 2	5.09	5.69	5.39
PEX 10	5.09	5.88	5.48
MEAN	5.29	5.86	5.58

DRILLING AQ N AUT	CNVNTIAL	DIRECT	MEAN
50	5.53	5.42	5.47
100	5.69	5.68	5.68
MEAN	5.61	5.55	5.58

DRILLING N INHIB	CNVNTIAL	DIRECT	MEAN
NITRAPYR	5.91	5.80	5.85
PEX 2	5.38	5.41	5.39
PEX 10	5.53	5.44	5.48
MEAN	5.61	5.55	5.58

DRILLING TOTAL N	CNVNTIAL	DIRECT	MEAN
150	5.32	5.26	5.29
200	5.89	5.84	5.86
MEAN	5.61	5.55	5.58

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79/R/WW/2 PASTURES(R)

GRAIN TONNES/HECTARE

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

N INHIB	NITRAPYR		PEX 2		PEX 10	
TOTAL N	150	200	150	200	150	200
AQ N AUT						
50	5.61	5.78	5.01	5.33	5.51	5.58
100	5.75	6.27	5.17	6.05	4.67	6.18

N INHIB	NITRAPYR		PEX 2		PEX 10	
DRILLING	CNVNTIAL	DIRECT	CNVNTIAL	DIRECT	CNVNTIAL	DIRECT
AQ N AUT						
50	5.78	5.61	5.13	5.22	5.67	5.42
100	6.03	5.99	5.63	5.60	5.40	5.45

TOTAL N	150		200	
DRILLING	CNVNTIAL	DIRECT	CNVNTIAL	DIRECT
AQ N AUT				
50	5.48	5.28	5.58	5.55
100	5.16	5.23	6.21	6.12

TOTAL N	150		200	
DRILLING	CNVNTIAL	DIRECT	CNVNTIAL	DIRECT
N INHIB				
NITRAPYR	5.76	5.61	6.06	5.99
PEX 2	5.08	5.11	5.69	5.70
PEX 10	5.13	5.05	5.94	5.82

TOTAL N		150		200	
	DRILLING	CNVNTIAL	DIRECT	CNVNTIAL	DIRECT
AQ N AUT	N INHIB				
50	NITRAPYR	5.65	5.58	5.91	5.64
	PEX 2	4.98	5.05	5.28	5.38
	PEX 10	5.81	5.22	5.53	5.63
100	NITRAPYR	5.87	5.64	6.20	6.34
	PEX 2	5.17	5.18	6.09	6.01
	PEX 10	4.44	4.89	6.35	6.00

DRILLING	CNVNTIAL	DIRECT	MEAN
EXTRA			
0	1.84	1.60	1.72
NC 50	3.03	3.60	3.31
NC 100	4.50	4.17	4.33
NC 150	5.81	5.85	5.83
NC 200	6.22	5.19	5.71
NC 250	5.78	6.38	6.08
MEAN	4.53	4.47	4.50

GRAND MEAN 5.22

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79/R/WW/2 PASTURES(R)

GRAIN TONNES/HECTARE

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

TABLE	AQ N AUT	N INHIB	TOTAL N	EXTRA
SED	0.288	0.153	0.288	0.706

TABLE	AQ N AUT N INHIB	AQ N AUT TOTAL N	N INHIB TOTAL N	AQ N AUT* DRILLING
SED	0.338	0.408	0.338	0.330
EXCEPT WHEN COMPARING MEANS WITH SAME LEVEL(S) OF:				
AQ N AUT	0.217			0.358
TOTAL N			0.217	

TABLE	N INHIB* DRILLING	TOTAL N* DRILLING	AQ N AUT N INHIB TOTAL N	AQ N AUT* N INHIB DRILLING
SED	0.217	0.330	0.478	0.414
EXCEPT WHEN COMPARING MEANS WITH SAME LEVEL(S) OF:				
N INHIB	0.379			
AQ N AUT				0.437
TOTAL N		0.358		
AQ N AUT.TOTAL N			0.307	
AQ N AUT.DRILLING				0.307

TABLE	AQ N AUT* TOTAL N DRILLING	N INHIB* TOTAL N DRILLING	AQ N AUT* N INHIB TOTAL N DRILLING	DRILLING* EXTRA
SED	0.467	0.414	0.586	0.809
EXCEPT WHEN COMPARING MEANS WITH SAME LEVEL(S) OF:				
TOTAL N		0.437		
AQ N AUT.TOTAL N	0.424		0.553	
TOTAL N.DRILLING		0.307		
AQ N AUT.TOTAL N.DRILLING			0.434	
EXTRA				0.622

* WITHIN THE SAME LEVEL OF DRILLING ONLY

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

STRATUM	DF	SE	CV%
BLOCK.SB	9	0.576	11.0
BLOCK.SB.HB	9	0.322	6.2
BLOCK.SB.HB.WP	16	0.434	8.3

GRAIN MEAN DM% 84.6

SUB PLOT AREA HARVESTED 0.00290

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79/W/WW/2 WARREN FIELD (W)

GRAIN TONNES/HECTARE

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

N INHIB AQ N AUT	NITRAPYR	PEX 2	PEX 10	MEAN
50	4.72	4.99	5.10	4.94
100	4.77	4.33	4.48	4.53
MEAN	4.74	4.66	4.79	4.73

TOTAL N AQ N AUT	150	200	MEAN
50	5.20	4.68	4.94
100	4.16	4.89	4.53
MEAN	4.68	4.79	4.73

TOTAL N N INHIB	150	200	MEAN
NITRAPYR	5.09	4.39	4.74
PEX 2	4.42	4.91	4.66
PEX 10	4.53	5.05	4.79
MEAN	4.68	4.79	4.73

AQ N AUT	TOTAL N N INHIB	150	200
50	NITRAPYR	5.19	4.25
	PEX 2	5.13	4.86
	PEX 10	5.27	4.93
100	NITRAPYR	4.99	4.54
	PEX 2	3.70	4.97
	PEX 10	3.80	5.16

EXTRA	0	NC 50	NC 100	NC 150	NC 200	NC 250	MEAN
	1.79	4.31	5.28	5.15	4.48	3.59	4.10

GRAND MEAN 4.52

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

TABLE	EXTRA	AQ N AUT	N INHIB	TOTAL N
SED	0.330	0.135	0.062	0.135

TABLE	AQ N AUT N INHIB	AQ N AUT TOTAL N	N INHIB TOTAL N	AQ N AUT N INHIB TOTAL N
SED	0.153	0.190	0.153	0.216
EXCEPT WHEN COMPARING MEANS WITH SAME LEVELS(S) OF:				
AQ N AUT	0.088			
TOTAL N			0.088	
AQ N AUT.TOTAL N				0.124

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

STRATUM	DF	SE	CV%
BLOCK.SB	9	0.190	4.2
BLOCK.SB.WP	8	0.124	2.7

GRAIN MEAN DM% 86.6 SUB PLOT AREA HARVESTED 0.0279

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