ROTHAMSTED RESEARCH

Yields of the Field Experiments 1977

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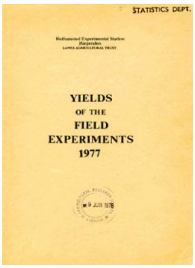

77/R/WW/2 and 77/W/WW/2 Aqueous N and Nitrification Inhibitors - W. Wheat

Rothamsted Research

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77/R/WW/2 and 77/W/WW/2

WINTER WHEAT

AQUEOUS N AND NITRIFICATION INHIBITORS

Object: To study the effects of adding a range of nitrification inhibitors to aqueous urea and aqueous ammonia on the yield and nitrogen uptake of winter wheat - Rothamsted (R), Fosters West and Woburn (W) Horsepool.

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

Design: 2 randomised blocks of 32 plots (Fosters West (R)). 2 randomised blocks of 37 plots (Horsepool (W)).

Whole plot dimensions: Fosters West (R) 4.27 x 10.7
Horsepool (W) 4.27 x 13.7

Treatments: All combinations of:-

1. N FORM(1) Form of aqueous nitrogen:

AMMONIA	Aqueous ammonia 26% N
UREA	Aqueous urea 18% N

2. N RATE Rate of nitrogen (kg N):

70
100

3. N TIME Time of applying aqueous nitrogen:

AUTUMN
SPRING

4. NIT INHB Nitrification inhibitors added to aqueous nitrogen:

NONE	None
NITRAPYR	Nitrapyrin ('N-Serve')
SOD TRI	Sodium trithiocarbonate

plus extra treatments given additional forms of nitrogen fertiliser in spring (kg N):-

N FORM(2)

0	0
NC 60	60 As 'Nitro-Chalk'
NC 70	70 As 'Nitro-Chalk'
NC 80	80 As 'Nitro-Chalk'
NC 90	90 As 'Nitro-Chalk'
NC 100	100 As 'Nitro-Chalk'
NC 110	110 As 'Nitro-Chalk'
NC 120	120 As 'Nitro-Chalk' (Fosters West (R) only)

and at Horsepool (W) only, in aqueous form:-

AS 100	100 As ammonium sulphate
AS 100NI	100 As ammonium sulphate + nitrapyrin and carbon disulphide
AN 100	100 As ammonium nitrate
AN 100NI	100 As ammonium nitrate + nitrapyrin and carbon disulphide
CN 100	100 As calcium nitrate
CN 100NI	100 As calcium nitrate + nitrapyrin and carbon disulphide

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77/R/WW/2 and 77/W/WW/2

NOTES: (1) Nitrification inhibitor rates:
Fosters West(R): Aqueous N applied with nitrapyrin at 1.4 kg or with sodium trithiocarbonate at 39 kg in autumn and with nitrapyrin at 1.0 kg or with sodium trithiocarbonate at 23 kg in spring.
Horsepool (W): Aqueous N applied with nitrapyrin at 1.5 kg or with sodium trithiocarbonate at 38 kg in autumn and with nitrapyrin at 1.0 kg or with sodium trithiocarbonate at 23 kg to N FORM(1) and nitrapyrin at 1.0 kg plus carbon disulphide at 5.0 kg as an emulsion to appropriate treatments of N FORM(2) in spring.
(2) Aqueous nitrogen was applied by injectors with tines spaced 30 cm apart, 10 cm deep.

Basal applications:
Fosters West (R): Manures: (0:20:20) at 310 kg, combine drilled. Weedkiller: Paraquat at 0.56 kg ion in 220 l, ioxynil at 0.53 kg plus mecoprop at 1.6 kg in 220 l. Insecticide: Pirimicarb at 0.14 kg in 280 l. Growth regulator: Chlormequat at 1.7 kg applied with weedkiller in spring.
Horsepool (W): Manures: (0:20:20) at 310 kg, combine drilled. Insecticide: Pirimicarb at 0.14 kg in 270 l.

Seed: Fosters West (R): Maris Huntsman, sown at 190 kg.
Horsepool (W): Maris Huntsman, sown at 180 kg.

Cultivations, etc.:-
Fosters West (R): Deep-tine cultivated twice: 25 Aug, 1976, 3 Sept. Aqueous N with inhibitors injected: 21, 25 Oct. Paraquat applied: 27 Oct. Heavy spring-tine cultivated: 20 Nov. Seed sown, spring-tine cultivated: 22 Nov. Aqueous N with inhibitors injected: 12-13 Apr, 1977. 'Nitro-Chalk' treatments applied: 2 May. Ioxynil plus mecoprop applied: 23 May. Insecticide applied: 15 July. Combine harvested: 8 Sept. Previous crops: Winter wheat and barley: 1975, winter oats 1976.
Horsepool (W): Deep-tine cultivated twice: 20 Aug, 1976, 23 Aug. Aqueous N with inhibitors injected: 12 Oct. Heavy-tine cultivated: 3 Nov. Seed sown: 4 Nov. Aqueous N with inhibitors injected: 14-15 Apr, 1977. 'Nitro-Chalk' treatments applied: 3 May. Insecticide applied: 11 July. Combine harvested: 9 Sept. Previous crops: Beans 1975, winter wheat 1976.

NOTES: (1) Soil samples were taken at monthly intervals, November to July for measurement of N in the injected bands. N was measured in a cross section of the band at Rothamsted only.
(2) Soil samples were taken at Woburn in selected plots to measure the amount of ammonium nitrate in the rhizosphere.
(3) Plant top samples were taken at fortnightly intervals from April until G.S.10 and then head samples for measurements of nitrate N.
(4) Flag leaf areas were measured several times during the growing season. Weights of the flag leaf and grain heads were also taken.
(5) Assessments were made of 'Take-all' (Gaeumannomyces graminis) on roots in selected plots at Woburn.
(6) At Woburn, waterlogging was noted at one side of the experiment and the effects of this were shown as a trend in yields. Yields presented have been adjusted for this trend.

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77/R/WW/2 FOSTERS WEST(R)

GRAIN TONNES/HECTARE

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

NIT INHB N TIME	NONE	NITRAPYR	SOD TRI	MEAN
AUTUMN	4.85	5.27	5.15	5.09
SPRING	5.39	5.64	5.56	5.53
MEAN	5.12	5.45	5.36	5.31

N FORM(1) N TIME	AMMONIA	UREA	MEAN
AUTUMN	5.08	5.10	5.09
SPRING	5.42	5.63	5.53
MEAN	5.25	5.37	5.31

N FORM(1) NIT INHB	AMMONIA	UREA	MEAN
NONE	5.03	5.20	5.12
NITRAPYR	5.44	5.46	5.45
SOD TRI	5.28	5.44	5.36
MEAN	5.25	5.37	5.31

N RATE N TIME	70	100	MEAN
AUTUMN	4.82	5.35	5.09
SPRING	5.27	5.78	5.53
MEAN	5.05	5.57	5.31

N RATE NIT INHB	70	100	MEAN
NONE	4.83	5.41	5.12
NITRAPYR	5.26	5.65	5.45
SOD TRI	5.06	5.65	5.36
MEAN	5.05	5.57	5.31

N RATE N FORM(1)	70	100	MEAN
AMMONIA	4.96	5.54	5.25
UREA	5.14	5.60	5.37
MEAN	5.05	5.57	5.31

NIT INHB	NONE		NITRAPYR		SOD TRI	
N FORM(1) N TIME	AMMONIA	UREA	AMMONIA	UREA	AMMONIA	UREA
AUTUMN	4.75	4.95	5.39	5.14	5.09	5.21
SPRING	5.32	5.46	5.49	5.78	5.46	5.66

NIT INHB	NONE		NITRAPYR		SOD TRI	
N RATE N TIME	70	100	70	100	70	100
AUTUMN	4.57	5.13	5.11	5.43	4.80	5.51
SPRING	5.08	5.69	5.41	5.86	5.33	5.79

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77/R/WW/2 FOSTERS WEST (R)

GRAIN TONNES/HECTARE

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

N FORM(1)	AMMONIA		UREA	
N RATE	70	100	70	100
N TIME				
AUTUMN	4.73	5.43	4.92	5.28
SPRING	5.20	5.65	5.35	5.91

N FORM(1)	AMMONIA		UREA	
N RATE	70	100	70	100
NIT INHB				
NONE	4.77	5.29	4.88	5.52
NITRAPYR	5.16	5.72	5.36	5.57
SOD TRI	4.95	5.60	5.18	5.70

N FORM(1)	AMMONIA		UREA	
N RATE	70	100	70	100
N TIME NIT INHB				
AUTUMN NONE	4.44	5.06	4.70	5.19
NITRAPYR	5.16	5.62	5.05	5.24
SOD TRI	4.58	5.61	5.03	5.40
SPRING NONE	5.10	5.53	5.06	5.85
NITRAPYR	5.15	5.83	5.67	5.90
SOD TRI	5.33	5.59	5.33	5.99

N FORM(2)	0	NC 60	NC 70	NC 80	NC 90	NC 100	NC 110	NC 120	MEAN
	3.81	5.11	5.56	5.62	5.72	5.95	6.41	6.19	5.55

GRAND MEAN 5.37

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

TABLE	N FORM(2)	N TIME	NIT INHB	N FORM(1)
SED	0.282	0.081	0.100	0.081

TABLE	N RATE	N TIME NIT INHB	N TIME N FORM(1)	NIT INHB N FORM(1)
SED	0.081	0.141	0.115	0.141

TABLE	N TIME N RATE	NIT INHB N RATE	N FORM(1) N RATE	N TIME NIT INHB N FORM(1)
SED	0.115	0.141	0.115	0.199

TABLE	N TIME NIT INHB N RATE	N TIME N FORM(1) N RATE	NIT INHB N FORM(1) N RATE	N TIME NIT INHB N FORM(1) N RATE
SED	0.199	0.163	0.199	0.282

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

STRATUM	DF	SE	CV%
BLOCK.WP	31	0.282	5.2

GRAIN MEAN DM% 81.6 PLOT AREA HARVESTED 0.00325

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77/W/WW/2 HORSEPOOL(W)

GRAIN TONNES/HECTARE

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

NIT INHB N TIME	NONE	NITRAPYR	SOD TRI	MEAN
AUTUMN	3.19	3.86	3.98	3.68
SPRING	5.04	5.03	5.15	5.08
MEAN	4.12	4.45	4.57	4.38

N FORM(1) N TIME	AMMONIA	UREA	MEAN
AUTUMN	3.49	3.86	3.68
SPRING	5.21	4.95	5.08
MEAN	4.35	4.40	4.38

N FORM(1) NIT INHB	AMMONIA	UREA	MEAN
NONE	4.14	4.10	4.12
NITRAPYR	4.42	4.48	4.45
SOD TRI	4.50	4.63	4.57
MEAN	4.35	4.40	4.38

N RATE N TIME	70	100	MEAN
AUTUMN	3.57	3.79	3.68
SPRING	5.00	5.16	5.08
MEAN	4.28	4.47	4.38

N RATE NIT INHB	70	120	MEAN
NONE	4.12	4.11	4.12
NITRAPYR	4.38	4.52	4.45
SOD TRI	4.34	4.79	4.57
MEAN	4.28	4.47	4.38

N RATE N FORM(1)	70	100	MEAN
AMMONIA	4.23	4.47	4.35
UREA	4.33	4.47	4.40
MEAN	4.28	4.47	4.38

NIT INHB	NONE		NITRAPYR		SOD TRI	
N FORM(1) N TIME	AMMONIA	UREA	AMMONIA	UREA	AMMONIA	UREA
AUTUMN	3.11	3.27	3.68	4.05	3.69	4.26
SPRING	5.16	4.93	5.16	4.91	5.30	5.00

NIT INHB	NONE		NITRAPYR		SOD TRI	
N RATE N TIME	70	100	70	100	70	100
AUTUMN	3.19	3.18	3.94	3.79	3.56	4.39
SPRING	5.05	5.04	4.82	5.24	5.12	5.19

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77/W/WW/2 HORSEPOOL (W)

GRAIN TONNES/HECTARE

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

N FORM(1)	AMMONIA		UREA	
N RATE	70	100	70	100
N TIME				
AUTUMN	3.39	3.59	3.74	3.98
SPRING	5.07	5.35	4.93	4.97

N FORM(1)	AMMONIA		UREA	
N RATE	70	100	70	100
NIT INHB				
NONE	4.15	4.12	4.09	4.10
NITRAPYR	4.36	4.48	4.40	4.55
SOD TRI	4.18	4.82	4.50	4.77

N FORM(1)	AMMONIA		UREA	
N RATE	70	100	70	100
N TIME NIT INHB				
AUTUMN NONE	3.18	3.04	3.21	3.33
NITRAPYR	3.79	3.57	4.09	4.00
SOD TRI	3.21	4.17	3.91	4.61
SPRING NONE	5.13	5.19	4.97	4.88
NITRAPYR	4.93	5.38	4.71	5.10
SOD TRI	5.14	5.47	5.09	4.92

N FORM(2)	
0	3.39
NC 60	4.25
NC 70	4.73
NC 80	5.13
NC 90	4.93
NC 100	5.25
NC 110	4.45
AS 100	5.63
AS 100NI	5.71
AN 100	5.08
AN 100NI	5.42
CN 100	4.46
CN 100NI	4.44
MEAN	4.84

GRAND MEAN 4.54

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77/W/WW/2 HORSEPOOL (W)

GRAIN TONNES/HECTARE

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

TABLE	N FORM(2)	N TIME	NIT INHB	N FORM(1)
SED	0.610	0.175	0.213	0.174

TABLE	N RATE	N TIME NIT INHB	N TIME N FORM(1)	NIT INHB N FORM(1)
SED	0.175	0.303	0.249	0.303

TABLE	N TIME N RATE	NIT INHB N RATE	N FORM(1) N RATE	N TIME NIT INHB N FORM(1)
SED	0.248	0.302	0.247	0.431

TABLE	N TIME NIT INHB N RATE	N TIME N FORM(1) N RATE	NIT INHB N FORM(1) N RATE	N TIME NIT INHB N FORM(1) N RATE
SED	0.429	0.350	0.431	0.610

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

STRATUM	DF	SE	CV%
BLOCK.WP	35	0.602	13.3

GRAIN MEAN DM% 83.2

PLOT AREA HARVESTED 0.00279

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